History of systematic botany in Australasia

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Australian Systematic Botany Society Inc.

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Contents

Preface

Taxonomists are constantly confronted with history. The selection of lectotype specimens requires an understanding of historical events associated with the naming of plants, and the rules of the *International Code of Botanical Nomenclature* dictate that we search historical literature for early plant names. These facts, plus a general interest in historical botany, led to my suggestion that the Australian Systematic Botany Society Inc. (ASBS) hold a botanical history symposium.

Following approval by ASBS council contributions, as papers or posters, on the following topics, which were to cover indigenous Australasian cryptogams and phanerogams, were called for: botanists and collectors — when and where they collected, locality of collections; establishment and holdings of herbaria; history of publications and sources of historical information; introduction of plants overseas and their subsequent description; and botanical art. To ensure that some topics were adequately covered three key-note speakers, i.e. Drs Richard Cowan, David Frodin and Charles Nelson, were invited to contribute papers. Many papers were offered and a symposium was subsequently held from 25–27 May 1988 at Ormond College, University of Melbourne.

This volume contains the majority of papers presented at the conference. It also contains papers derived from the poster session. Initially papers derived from the latter source were not to be published in this volume. However, as all posters contained valuable information that should be available to the botanical community, most are presented here. Because of this the only papers presented in the same order as in the symposium are the first, by Jim Willis, and the last, by Alex George. Others have been grouped, at times somewhat loosely, under general headings. The style of presentation naturally varies with author and really needs no comment. However, readers should note that some authors chose to publish manuscripts in the form they were read at the symposium. Others extensively modified their manuscripts after the symposium and so this volume is not a true reflection of the papers presented at the May conference.

Original letters and manuscripts concerned with the production of this volume are housed in the library of the National Herbarium of Victoria (MEL).

The success of the symposium was the result of the efforts of many people and organisations, i.e. other members of the symposium committee (Helen Cohn, Barry Conn, Rex Filson, Don Foreman & Neville Marchant), Bloomsbury Conference Services, ASBS Council, the Maud Gibson Trust and the Sydney Botanic Gardens who provided funds, and of course the contributors. It is perhaps rude to single out contributors as all papers and posters were gratefully received. However, I was especially pleased to receive contributions from overseas colleagues, especially Jennifer Lamond and Alan Bennell who could not attend the conference, and from our officially retired, but still very active colleagues, Dr Sophie Ducker and Dr Jim Willis, both of whom have made extensive contributions to our knowledge of Australian botanical history.

For assistance with the production of this volume I am indebted to many people, but particularly my colleagues at MEL, including Jim Ross for allowing me the time to edit manuscripts, Doris Sinkora for extensive comments on several papers, Anita Barley for the cover illustration, and Joan Thomas (and several typists at NSW) for retyping some manuscripts. Don Foreman was particularly generous with his time, and indeed very patient, as I battled to become familiar with the intricacies of a personal computer. Don also provided some editorial advice. However, my most sincere thanks are reserved for Helen Cohn, MEL librarian, for her constructive comments on editorial matters and the content of many manuscripts.

P. S. SHORT

Melbourne: a focal point for early botanical activity

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Abstract

Ferdinand von Mueller made Melbourne the chief centre of botanical activity in Australia during the 44 years that he laboured there. His botanical journeys, and collections therefrom, led to the establishment in 1853 of a colonial herbarium that evolved into the National Herbarium of Victoria. The preparation of *Flora australiensis* in seven volumes (Bentham 1863–1878), also Mueller's (1858–1882) classical 12-volume *Fragmenta phytographiae Australiae* are important earlier by-products of this institution. He was most interested in acclimatization and interchange of plant seeds, and he also investigated plant fossils. Mueller was involved with the Field Naturalists Club of Victoria, contributing numerous papers to its journal and encouraging its specialist, if amateur, members with their projects. His death, in 1896, left a vacuum in Victoria's floristic research that was only partly relieved by the arrival of A. J. Ewart from England in 1906.

Through the commendable foresight of Charles Joseph La Trobe, Superintendent of Port Phillip District, N.S.W., Melbourne's embryonic Botanic Garden was established in 1846, only 11 years after foundation of the settlement; he also reserved space for the Fitzroy and Carlton (Exhibition) Gardens. At this time virtually no botanical work had as yet emanated from the infant Melbourne, except perhaps for some 'extensive and excellent collections' (Hooker in Maiden 1908, p.102) around the settlement by one Frederick Adamson between 1840 and 1855 — specimens had been sent to Kew Herbarium.

By contrast, Sydney's Botanic Gardens (1816) had an advantage of 30 years and its collectors — notably Charles Fraser, Allan Cunningham, James Anderson, James Kidd and Charles Moore — had made substantial contributions from the environs of Port Jackson and far beyond, not to mention the achievements of such earlier visiting plantsmen as Joseph Banks (plus his entourage), John White, Luis Neé, George Caley, Robert Brown, Leschenault de la Tour and Franz Sieber.

John Arthur and John Dallachy, both Scottish gardeners, were the two first superintendents of Melbourne Botanic Gardens; neither was a trained or active botanist, but they doubtless gave advice on such botanical matters as identifications. Daniel Bunce (1813–72) claimed the distinction of being Victoria's first resident botanist. He had come to this colony as a horticulturist from Tasmania in 1839, and later went on to establish Geelong's Botanic Garden in 1857.

Concurrently with a movement of population from South Australia towards the newly discovered goldfields in Victoria, young Dr Ferdinand J. H. Mueller arrived in Melbourne from Adelaide during August 1852. Well accredited in botanical circles, he was appointed within five months to the position of Victoria's first Government Botanist (on 28 January 1853), and he immediately commenced a series of stupendous exploratory journeys by horseback and on foot. By the end of 15 months he had covered 6,400 km and netted 1,459 species of plants not previously recorded for Victoria, many of these being undescribed (Mueller 1853, 1854). Other explorations followed year by year, throughout and beyond the colony, bringing in a wealth of information that was soon to be disseminated by published accounts containing descriptions of a myriad of new species. A conservative estimate of his total travels by land would be 24,000 km, half of it in Victoria.

Probably Mueller's greatest achievement was in establishing the Melbourne Herbarium (MEL) which could be said to date from 1853 when he reported that 'a collection of dried specimens of plants has been commenced for the Government. This Herbarium will be at all times accessible to the public' (Mueller 1853, p.7). It was initially housed in his new cottage above Gate H of the Botanic Gardens, and by 1857 in the Director's residence (built 1854). During 1860–1861 the specimens were transferred to much more commodius quarters (the 'Old Herbarium') erected in The Domain; Mueller and his staff always referred to the repository as 'the Museum'. By 1869 the rapidly increasing number of specimens had risen to 350,000 (Mueller 1869). In the 1860s Mueller kept his own private herbarium separate from the larger government collection, but it is not known precisely when he donated the former material for amalgamation in a single national collection. His considerable and valuable library was purchased by the Government (for the Herbarium) in 1898 — two years after Mueller's death.

The National Herbarium of Victoria (MEL), moved to its present site and building in 1935, has grown to be the largest in Australia (probably also in the southern hemisphere) and by far the richest in historic collections and type material. The Australian specimens gathered on such expeditions as those of A. C. Gregory (1855–1856 & 1858), B. H. Babbage (1858), J. McD. Stuart (1860–1862), Burke & Wills (1860–1861), A. W. Howitt (1861–1862), J. & A. Forrest (1869–1871), W. E. P. Giles (1872–1875), W. H. Tietkens (1889)

and D. Lindsay (1891–1892) all came to Melbourne for examination by Mueller who worked through them, describing many novelties. Between 1876 and 1882 Lutheran missionaries F. A. H. Kempe and W. F. Schwarz supplied Mueller with hundreds of plant species from their Centralian station at Hermannsburg (Kempe 1880, 1882). Amongst Melbourne's special treasures are many duplicates from the early gatherings by Joseph Banks (1770) and Robert Brown (1802–1805), both donated by the British Museum (Natural History). Then there are a set of J. A. L. Preiss's Western Australian collections (1838–1841) and J. G. C. Lehmann's type-rich folders which were purchased as part of the great Otto Sonder herbarium (about 250,000 specimens) between 1870 and 1883 — they contain sheets from 18th century botanists, a few having even belonged to Linnaeus! These priceless resources remain as essential points of reference for most taxonomic research on the Australian flora.

The seven-volume *Flora australiensis* (Bentham 1863–1878) was a literary monument to the collaborative skills of two brilliant men working from opposite ends of the world, George Bentham at Kew and Ferdinand Mueller in Melbourne. Over a period of 16 years tens of thousands of Australian specimens were successively packaged by Mueller, shipped to London and returned when investigated by Bentham, without loss or damage — could one expect as much in these modern days of sophisticated handling and rapid transport? After more than a century, *Flora australiensis* still remains the only definitive work on the vascular vegetation of the whole continent.

A remarkable production of Mueller's was the *Fragmenta phytographiae Australiae* (twelve volumes in 94 fascicles between 1858 and 1882) wherein he described many of his 2,000 odd new species of plants (Mueller 1889). This work holds the unique distinction of being Australia's only scientific periodical to be printed entirely in Latin. Mueller's other writings are voluminous — some 1,330 items ranging from notes, plant lists, pamphlets and articles with original descriptions to floristic handbooks and immense monographs (Churchill *et al.* 1978). He wrote innumerable reports on the plant species accruing from various expeditions throughout Australia.

Mueller was Australia's first palaeobotanist, working and publishing (1871–1883, see Churchill *et al.* 1978) on the plant fossils turned up in Tertiary sediments by mining operations, especially along the deep leads under basalt . Excepting ferns, he sent to appropriate experts overseas all other cryptogams — bryophytes, algae, fungi and lichens. A stimulating early experience was to meet the renowned phycologist, Professor W. H. Harvey of Dublin University, who spent four months of spring and early summer 1854 in collecting seaweeds along the Victorian coastline (between Phillip Island and Port Fairy); Mueller rendered ample assistance and accompanied Harvey on several nearer excursions. After 18 months' collecting in various parts of Australia, Harvey returned to Ireland with 20,000 specimens — replicates of many are in MEL.

Another important involvement was Mueller's almost obsessive interest in acclimatization of plants suitable for timber, food, medicine, ornament, sand-binding and other uses. Many of our most acceptable trees in forest plantations, parks and gardens bear witness to the success of his early introductions. In the year 1857/58 alone he had distributed 7,120 living plants and 22,438 packets of seed to gardens throughout the colony (Mueller 1858). Vast amounts of Australian seed (notably of *Eucalyptus*) were also sent abroad to various climatically favourable countries in both Old and New Worlds. A startling success, that earned him a papal knighthood, was to render habitable the fever-ridden Pontine marshes near Rome by plantations of *Eucalyptus globulus*, commencing in 1870.

For more than 40 years Ferdinand (later Baron von) Mueller held undisputed sway as Victoria's, if not Australia's, most productive, distinguished and highly decorated scientist. No other single person could match the output of this incredibly hard-working and dedicated explorer, geographer, horticulturist, phytochemist and systematist par excellence. In a very real sense the name of Mueller became synonymous with botanical endeavour throughout the colony and he certainly focussed attention on Melbourne as an important centre of culture and research. For the first three decades of Mueller's service, Victorian botany had been virtually a one-man show aided by a few rather faceless local amateurs. It is therefore interesting to speculate how and when botanical activity might have been generated here *without* the presence of a Mueller.

As the Baron aged, his fieldwork slackened off, and there were no exploratory marathons after 1877. Henceforward he concentrated on literary undertakings and much correspondence (to 3,000 letters per annum), while younger collectors provided him with needful specimens. Thus he enlisted, and inspired, a veritable army of willing enthusiasts from many walks of life — e.g. school teachers, doctors, clergymen, postal employees, surveyors, miners, farmers and their womenfolk.

A vital factor in promoting botanical activity in and around Melbourne was the Field Naturalists Club of Victoria, founded in 1880 with von Mueller as its patron and staunch supporter. The club's journal, *The Victorian Naturalist*, began on a monthly basis in 1884 and Mueller was a frequent contributor to its pages — 79 articles and notes to August 1896. As well as general observers and collectors of plants, the club had several members with specialist knowledge, viz.: Charles French (orchids and ferns), Daniel Sullivan (mosses), Rev. Francis Wilson (lichens), Henry Tisdall (fungi and algae), John Bracebridge Wilson (algae), Henry Watts (algae) and Prof. Arthur Lucas (algae) — all contributed papers to *The Victorian Naturalist* (Willis 1949).

Mueller's death in October 1896 left a vacuum in botanical effort that took many years to fill. As historian Lionel Gilbert reminds us, 'When he was ousted [in 1873] the Botanic garden by the Yarra became beautiful but intellectually void. Systematic botany in Victoria has been a long time recovering' (Gilbert 1986, p. [ix]).

Some renewal of collecting activity and an impetus to taxonomic work followed the arrival from England of Professor Alfred J. Ewart early in 1906. Ewart held the dual position of Government Botanist and head of the Botany School at Melbourne University, dividing

his time between the National Herbarium and the University. With a depleted staff, the severe exigencies of World War I and Ewart's departure in 1921 to full-time duties at the Botany School, Melbourne's Herbarium sank into a slough of unproductiveness, if not complete inertia, over a period of some three decades — until World War II. Only *The Victorian Naturalist* and research papers by Professor Ewart's students and associates, published in *Proceedings of the Royal Society of Victoria*, helped to keep systematic botany alive in this State until the 1940s. Significant highlights in this comparative limbo had been *A census of the Plants of Victoria* (1923, revised in 1928), prepared and published by the Plant Names Committee of the Field Naturalists Club of Victoria — a most useful pocket book retailing at three shillings & sixpence — and A. J. Ewart's long-awaited, rather bulky, single-volume *Flora of Victoria* (Ewart 1931).

Most other State Herbaria are controlled by appropriate departments; but, until quite recently, Melbourne's had been bedevilled by its location either within the Chief Secretary's Department or that of Crown Lands & Survey where due appreciation and understanding of botanical needs were often-times minimal or sometimes completely lacking.

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Politics and the purchase of private herbaria by the National Herbarium of Victoria

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Abstract

The National Herbarium of Victoria (MEL) has obtained large numbers of specimens through exchange, donation and the activities of its own staff. However, its importance to Australian and overseas taxonomists is largely the result of the purchase of private collections. Herbaria have been purchased from botanists such as R. A. Black, J. Drummond, C. F. Ecklon, M. Koch, F. M. Reader, O. W. Sonder, J. Steetz and F. R. M. Wilson. Notes on their content, cost and date of purchase are provided.

Ferdinand Mueller requested the acquisition of Sonder's herbarium in 1859 but the bulk of it was not purchased by the Victorian Government until 1883. The political perception of the value of scientific research is discussed in relation to this purchase.

Ferdinand Mueller was appointed Government Botanist of Victoria in 1853, retaining that office until his death in 1896. Within a few days of his appointment he commenced his first collecting trip, a journey of more than 2,500 km through eastern Victoria (Mueller 1853). He returned with a collection which is generally regarded as the foundation of the National Herbarium of Victoria (MEL) (Pescott 1982). The herbarium grew rapidly through Mueller's efforts and five years after its inception it contained about 45,000 specimens representing 15,000 species (Mueller 1858). In September 1865 it was reported to have about 286,000 specimens (Mueller 1865), in September 1868 approximately 350,000 (Mueller 1869b). More than half a million specimens were said to be present in 1888 (Mueller 1888) and three years later Mueller (1891) noted that MEL contained about 750,000 collections. Several years later he (Mueller 1894) suggested a total of approximately one million sheets.

Mueller's figures are somewhat conflicting. In a letter to A. P. de Candolle he (Mueller 1880) referred to an estimated 300,000 sheets in MEL, of which 120,000 were of Australian plants, 180,000 of extra-Australian plants. Recent estimates of the size of the MEL collections, including phanerogams and cryptogams, suggest that we have a little over one million specimens.

As with any major herbarium MEL has obtained large quantities of specimens through exchange, donation and the activities of its own staff (e.g. see Mueller 1860a, 1862). However, MEL's importance to both Australian and overseas botanists is largely the result of the purchase of private herbaria. (The term private herbaria excludes collections obtained from paid collectors who received, if not a wage, then at least some allowance to cover the cost of acquiring specimens.) In this paper an account of herbaria acquired since MEL's inception is presented. Where possible notes are provided on the content, cost and date of purchase of each herbarium. Particular attention is paid to the purchase of O. W. Sonder's herbarium, the history of its purchase providing an insight into the political perception of scientific research and the personality of Ferdinand Mueller.

It must be stressed that additional material pertaining to MEL'S acquisition of private herbaria, particularly minor herbaria, is still likely to be located in official files. It is also certain that much information pertaining to such acquisitions was lost when F. J. Rae, a past Government Botanist and Director of the Royal Botanic Gardens, Melbourne, permitted the destruction of old records and correspondence at the time of transfer from the old to the new herbarium in 1934–1935 (Pescott 1982). This included the destruction of Mueller's incoming correspondence from both local and overseas botanists. Nonetheless it seems likely that all major purchases are included in this paper.

Herbaria purchased after 1896

Francis Robert Muter Wilson (1832–1903)

For many years the Presbyterian minister at Kew (Melbourne), the Rev. Wilson should possibly be regarded as Australia's pioneer lichenologist. From 1897 to 1900 he wrote at least twenty articles on lichens and described many new species (Willis 1949). Maiden (1908) indicated that Wilson's herbarium was purchased by the National Herbarium of New South Wales (NSW). However, it is evident in a letter from Professor A. J. Ewart (part-time Government Botanist, 1905–1921) to Dr G. Albo, an Italian botanist, that MEL also had a set. In the letter (dated 10 September 1907) Ewart (1907) said in part:

> The material already sent was accumulated by the late Rev. Wilson during his later years, & was included in the collection purchased from his Widow after his death. I am now sending you the whole of this collection, named & unnamed, so that full comparison will be possible. The material you have already received has not been worked on by anyone else, & the whole is probably the most com-

plete collection of Australian Lichens extant, although the Sydney Herbarium has a fine set.

Two further letters from Ewart to Albo (Ewart 1908a,b) reveal that the case of lichens sent to Sicily weighed over one hundredweight (c. 45 kg) and that the Government of New South Wales had paid £100 for the set at NSW. Regrettably the letters also reveal that the lichen collection was lost in transit, having never been received by Albo. This most valuable set of specimens has never been recovered.

Felix Maximillian Reader (1850–1911)
Reader, born in Berlin and trained as a chemist, emigrated to Australia and had a chemist's business in Dimboola, Victoria in the 1890s and early 1900s. He was an assiduous collector of phanerogams and cryptogams and published many papers on the Victorian flora in the *Victorian Naturalist*. He was an expert on the grasses of the southern Wimmera and described several new species. His moss collections were dealt with by the Finnish botanist, V. Brotherus and the German, C. Müller.

Details have not been ascertained but Willis recorded that Reader's collections 'were purchased for the National Herbarium where they rank [for Victoria] second only to Williamson's in point of size and importance' (Willis 1949, p. 125). In unpublished notes (MEL library) he further recorded that Reader sold his collection to MEL in 1906.

Max Koch (1854–1925)
Koch, born in Berlin, worked at an early age as an apprentice in a merchant's office but finding the work not to his liking he travelled to Australia, arriving in 1878. For many years he worked at Mount Lyndhurst sheep station but in 1904 he left to settle in Western Australia where he was employed in saw milling work. He devoted much of his spare time to collecting herbarium specimens and seed for sale. Writing from Pemberton of his considerable botanical activities Koch (1925) noted that:

> Taking into consideration that all this work has been achieved after doing 7 night shifts per week (from 1908 to 1915 and 1916 to 1919) of 12 hours duration and that several hours per day had to be given to household duties [such] as making a vegetable garden, looking after a fowl run, building and improving the house etc, the performance is probably hard to beat. It was however a labour of love and the incentive of increasing my income and thus enabling me to keep my at that time large family in more comfortable circumstances made me turn every minute to the best use. I certainly had no idle moments!

The Government Botanist of New South Wales, J. H. Maiden, used sets of Koch's collections for exchange purposes, thus building the holdings of NSW (Audas 1929).

More than 40 species were described as new from specimens collected by Koch, including the wreath lechenaultia, *Lechenaultia macrantha* Krause.

Mr J. G. Luehmann, Government Botanist at MEL immediately after Mueller's death, purchased herbarium specimens as well as seed from Koch, a fact noted by Koch (1925) in a letter to William Laidlaw, Government Botanist after Ewart. Koch stated that Luehmann had bought 200–300 sheets of Western Australian plants. Further details are lacking.

Raleigh Adelbert Black (1880–1963)
Willis (1967) published on Black's life and herbarium. He described Black as a 'remarkable, largely self-taught and many-sided man [who] was undoubtedly the most important collector of Tasmanian vascular flora during the first half of the present century' (Willis 1967, p. 237). In 1952 Black estimated that his collection amounted to about 15,000 specimens, of which 9,000 were mounted numbers and about 6,000 were unmounted duplicates. Although the majority of the collections are Tasmanian the herbarium, not yet completely incorporated into the general holdings at MEL, contains specimens from Victoria, New South Wales, the Kimberley Ranges, Britain, Belgium and America, particularly Canada. With the exception of ferns and clubmosses no cryptogams are included. Willis (l.c.) recorded that negotiations for the herbarium's disposal commenced in 1946 with the Arnold Arboretum, Massachusetts. Offers were also sought from Canberra (CANB), Hobart (HO) and Kew (K) but Black's evaluation was deemed to be too high. The collection was eventually purchased by MEL in August 1957 for £300.

Herbaria purchased during Mueller's term of office as Government Botanist (1853–1896)

Minor herbaria
The MEL library holds a single account book from Mueller's period of office as Government Botanist. It covers the years 1868–1872 (Mueller 1868–1872) and lists a number of small collections that were purchased. Other account books appear to have been casualties of Rae's wanton act of destruction. Entries are summarized in Table 1. It should be noted that the register records the acquisition of garden plants as well as herbarium material and it may well be that some of the entries in the table are for live plants. Importantly, all payments were for recently collected Australian specimens and purchase prices were low, ranging from £2/1/- for dried plants from Cape Le Grand (probably from George Maxwell) to £12/10/- for botanical specimens from Joseph Nernst of Mackay, Queensland.

Mueller (1883a), in a letter to J. Agardh, referred to a packet of algae from Israelite Bay which was purchased from, but not collected by, a Mr Webb (probably William Webb, ?1834–1897).

Details are lacking but Fischer-Benson (1890) recorded that Mueller purchased C. F. Ecklon's (1795–1868) collection of Schleswig (Germany) plants. It is also likely that MEL purchased specimens gathered by G. W. Schimper (1804–1878). Mueller reported to the government that among the contributions received at the botanical museum were 'Abyssinian plants collected by Dr. Schimper, and communicated by Professor Hochstetter, of Vienne' (Mueller 1862, p. 8). Schimper, a German botanist, resided for many years in Abyssinia and made his living by collecting and selling plants. He sold many of his specimens through the Unio Itineraria, a botanical exchange society in Ess-

Table 1
List of purchased herbaria at MEL compiled from the Government Botanist's register of accounts (Mueller 1868–1872)

Date	Purchase	Price £ s d
1868		
24 March	'Bot. specim. bought off J. Nernst'	2 10 0
1 May	'600 bot. specim. bought off C. Stuart'	7 10 0
6 May	'Bot. specim. & seeds bought off C. Walter'	5 0 0
13 July	'Seaweeds & Acacia seeds bought off C. Lane, Queenscliff'	2 5 0
3 Aug.	'1200 botan. specim. at pr 100 5/-'	3 0 0
11 Nov.	'Purchase of collection of bot. specimens from King's Island'	7 0 0
31 Dec.	'Purchase of collection of plants from King's Island'	8 0 0
1869		
6 March	'Botanical specimens bought from Jos. Nernst'	12 10 0
19 June	'Plants & seeds fr. G. Maxwell'	2 1 0
13 July	'Purchased from Sam. Hannaford, Hobart Town a collection of Tasmanian Algae'	6 5 0
14 Sept.	'Dried plants fr. Le Grand'	2 1 0
1870		
10 April	'Collect. of plants purchased from Ch. Stuart'	5 0 0
14 April	'Plants & seeds collected in East Gippsland'	4 10 0
1871		
12 Feb.	'1 collection of Queensland timber specimens, containing 36 species purchased from Mr O'Shanesy'	5 0 0
1 Aug.	'3 collect. of plants from E. Bowman, Gainsford, Peak Downs, Broadsound'	5 0 0
3 Jan.	'Collns from Percy, Lizard, Fitroy, Clermont & Howick Isles & Cape Sidmouth, Queensland'	4 9 0
5 Jan.	'1 coll. of dried plants from Mt Wellington'	2 10 0
16 April	'1 coll. of dried plants from Mt Arrowsmith'	3 0 0
8 July	'Collection of plants from Mt Dryander purchased from E. Fitzalan & ditto from Mt Elliot'	10 0 0
3 Oct	'1 collection of dried plants & seed from Mt Elliot, purchased from E. Fitzalan'	5 0 0
1873		
3 March	'Large collection of dried plants for botanical museum, also palm & other seeds and living plants, collected on Lord Howe's Island purchased from Mr J. P. Fullager'	10 0 0
18 April	'Collection of dried plants from Tasmania from Th. Gulliver'	4 10 0

lingen, Germany administered by R. F. Hohenacker and E. G. von Steudel (Gunn & Codd 1981, Stafleu & Cowan 1985).

James Drummond (1784–1863)

Born in Scotland, James Drummond, his wife and six children settled in the Swan River Colony in 1829. Part of his income was derived from the sale of botanical specimens to overseas botanists and today his collections are to be found in about 25 herbaria (Erickson 1966). A large number of species were described from his collections, with 119 being named after him, by botanists such as George Bentham, Asa Gray, William Hooker, John Lindley and Nicholas Turczaninow.

Erickson (1966) noted that Drummond collected about 3,500 numbers for each of his subscribers and also recorded that James Drummond junior (1814–1873) sent his father's 'key collection' to MEL. Her accounts of Drummond (Erickson 1966, 1969) do not suggest that the collection was purchased and Mueller referred to the 'late meritorious James Drummond, from whose enlightened son the Melbourne botanical museum received the whole normal collection of plants secured by his father during a long series of years in West Australia, many of the plants being solely contained as yet in this collection' (Mueller 1867, p. 212). However, in a subsequent article he stated that 'About 1859 [1863] Dr. Steetz's important collections were added by departmental purchase; later, by the same means, Mr. T. [J.] Drummond's set of West Australian plants, and various other collections' (Mueller 1888, p. 212).

Drummond's private collection must include many isosyntypes. Presumably it also includes a number of syntype specimens. Drummond himself named a few Western Australian plants, including the spectacular *Hakea victoria* Drumm.

Whether Mueller had previously acquired specimens directly from Drummond does not seem to be recorded. Most certainly MEL received some additional Drummond collections through the purchase of the private herbaria of Steetz and Sonder.

Joachim Steetz (1804–1862)

The subject of a recent paper (Short & Sinkora 1988), the herbarium of the Hamburg botanist Joachim Steetz was purchased in 1863 for the sum of £80 sterling. Over 160 collectors contributed specimens from more than 30 countries to Steetz's herbarium. Important contributors included N. J. Andersson, N. Binder, J. D. Hooker & T. Thomson, B. Seemann, F. W. Sieber and N. S. Turczaninow. The total size of the herbarium is unknown, but Mueller did note that it consisted of 15 large packing cases and no less than 418 packages, suggesting a minimum total of perhaps 5,000 collections.

Steetz's herbarium contains a large number of type specimens, particularly in the Compositae, a family in which Steetz specialized. From the Australian perspective the most important component of the herbarium is a set of collections gathered by Ludwig Preiss in Western Australia. The presence of the set certainly delighted Mueller and was perhaps one of the main reasons why he purchased the herbarium, although MEL already had 400 Preiss collections acquired from Sonder (Short & Sinkora l.c.).

Otto Wilhelm Sonder (1812–1881)

The German botanist O. W. Sonder qualified as an apothecary in Berlin in 1835 (Stafleu & Cowan 1985). Mueller noted that for more than 30 years Sonder was the proprietor of a leading pharmaceutical establishment in Hamburg and for a similar length of time was a member of the medical board. He stated that Sonder's 'zeal, ability, and great working power allowed him to carry on independent progressive work in his favourite science — that of botany — irrespective of his extensive professional engagements' (Mueller 1882a, p. 69).

Sonder's publications included an enumeration of the Epacridaceae, Stylidiaceae and the algae in Lehmann's *Plantae Preissianae*, descriptions of many families in *Flora capensis*, which he co-edited with W. H. Harvey, and a flora of Hamburg. He was also editor, and author of many families, of *Plantae Muellerianae*, published in several volumes of *Linnaea*.

Purchase of Sonder's herbarium

Sonder had an enormous, private herbarium which was available for purchase during his own lifetime. The bulk of the herbarium was purchased by MEL but its acquisition was a prolonged affair. Extracts from documents pertaining to its purchase have previously been published by Margaret Willis (1949) but since then additional material has been located and is included in this summation.

The first available record relating to the purchase of Sonder's herbarium appears in a memorandum from Mueller (1859) to the Chief Secretary of Victoria. It is dated 1 November 1859. In it Mueller stated that he would respond to the government's request that he assist George Bentham in the proposed Australian flora. He added:

> But I feel it my duty to inform your Honour that this proposed labour could be greatly facilitated if I could in addition to my own since the last 20 years accumulated collections (now all property of the Government) secure the great Sonderian Herbarium, which is the richest of all private botanical collections in existence. In a letter which I had lately the honour of advising on the subject to Mr Undersecretary Moore, I pointed out that such acquisition, altho' in first instance a costly one, would save the expense of time & money in accumulating gradually such herbarium, whilst the possession of such is after all everuseful, if we wish not only to keep pace with the progress of science elsewhere, but intend to advocate share in its advancement. The possession of the herbarium alluded to would render us hence, myself & my successors independent of European botanical museums, where at present alone monographic labours can be successfully executed.

In the following year Mueller (1860b) wrote to the Chief Secretary, justifying the £1,600 which he had placed on the 1861 schedule of estimates. He did not refer to the Sonder herbarium, merely stating that the money was for 'certain botanical collections, obtainable at present in Europe'. The next year Mueller (1861) suggested that 'in the original estimate of expenditure for this establishment, anticipated as requisite for 1862 and as submitted by me to the late Government. . .a reduction may be effected by omitting the item "towards the enlargement of the collections at the botanical museum £1,600", soliciting at the same time, that the grant of this particular item. . .may at a future year be favourably entertained.' Two years later he (Mueller 1863) submitted a proposal to the Undersecretary that £1,200 be placed on the estimates for 1864 for the purchase of Sonder's herbarium, the same price cited in a further memorandum submitted in 1866 (Mueller 1866).

In 1869 a payment of £120 was made to the Agent General in London (Mueller 1869). Specific documents pertaining to this purchase are not forthcoming for that year but it is apparent from a much later memorandum (Mueller 1873) that an agreement had been reached to purchase Sonder's herbarium by either ten instalments of £120 each or for a lump sum of £1,000. With this in mind Mueller (1869c), in the same year, requested that a sum of £880 be allocated for 1870.

On 6 April 1870 Mueller (1870) reported to the Chief Secretary that three cases from Sonder's herbarium had arrived safely. But no more cases and no additional payment for specimens was forthcoming. September 1871 (Mueller 1871) saw a renewal of requests for acquisition of this 'treasure'.

Further memoranda were also forwarded in 1873 and 1874 (Mueller 1873, 1874a,b; Willis 1949, p. 106). However, no action was taken, despite the fact that at this stage of proceedings N. J. Andersson, of the Swedish Museum of Natural History (S) had approached Sonder asking to purchase his entire herbarium. He could not raise the finance but did purchase a large South African component in 1875. About the same time there had been an offer from France to purchase Sonder's Australian specimens. Mueller was apparently kept informed of Sonder's dealings (Nordenstam 1980).

Mueller persisted with his overtures and wrote to the Undersecretary in December 1881 (Mueller 1881) requesting an interview with Chief Secretary, J. M. Grant. A month later he (Mueller 1882b) again requested an interview with Grant, having just heard in the last mail that Sonder had died. He (Mueller 1882c) also wrote in February of that year to Dr L. L. Smith, member of the Legislative Assembly. The memorandum read in part:

> Permit me. . .to bring under your consideration as a medical Gentleman a subject of professional and scientific importance to our colony, especially as your well known interest in science and your influence as a Minister of the Crown would greatly facilitate the object in view. The sudden death of Dr Sonder, one of the leading botanists of his age and a celebrated author of numerous works, renders now his magnificent collection of dried plants purchasable. . .So soon as his death became known in England, the British Museum offered to purchase the collection. . .but the widow of Dr Sonder, aware of my scientific intimacy and almost uninterrupted professional correspondence for nearly 40 years with her husband, declined any offer, until she had heard from me. Dr Sonder. . .was for many years anxious himself that the collections should pass into my hands, and in our correspondence he expressed himself satisfied to accept for the whole £900. . .May I therefore ask you to speak kindly on this subject to the Hon. Sir Bryan Loughlin, the Premier, and the Hon. J. M. Grant, the Chief Secretary, so that I may write a definite answer on this subject by one of the next mails.

Smith was interested. Ten days later Mueller (1882d) wrote the following, his most informative memorandum dealing with the Sonder herbarium, to him.

> In reply to your question, dear Dr Smith, I beg to observe that the Sonderian Collection of dried plants contains specimens from all parts of the globe, including even numerous specimens from the least accessible parts of tropical South America, India and other parts of the globe. Indeed it is one of the very richest ever formed by a private Gentleman, and its historic value consists in the exceedingly large number of autograhic specimens connected with published works, the authentic material reaching back to the earlier part of this century, when Dr Sonder commenced his interchanges with aged botanists. Numerically the collection comprises very many thousands of species, and each of them is represented by a series of specimens indicative of the geographic range and forms of varieties, thus the whole forms a huge mass of specimens, and would constitute a magnificent supplement to what I have gathered myself since 42 years. Among the gems of the collection is the unique set of Algae (Seaweeds), on which sorts of plants Dr Sonder was

one of the three great workers of this age. Indeed as a whole the collection is so valuable that any other colony even near us would gladly secure it for the botanic Museums, such authenticated collections being incalculable value for all times for reference. As instances, how much collections of great bot. authors are sought, I may remark, that some years ago Dr Meissner's collection (then at Basel and offered to me by himself in first instance) was purchased for £2,000 by an American Merchant and presented to the City of New York. When the great Lindley was on his last sickbed he also was anxious that I should secure his highly important collections for Victoria, after Sir Joseph Hooker had secured the Orchids (dried specimens) for which alone he paid five hundred £! The collection was subsequently bought for a London Institution. Therefore no difficulty exists in disposing of the Sonderian collections, which the British Museum is eager to get, but which Mrs Dr Sonder in accordance with the wish of her late husband prefers seeing pass into my hands.

[Mueller then briefly referred to placing Sonder's herbarium in the Exhibition Building. There was inadequate space at the botanic museum. He then explained how the collections were stored and referred to their cost.]

In answer to your question about the form of the collection, I may observe, that Dr Sonder kept them as usual in parcels covered by pasteboards. There are many hundreds of such parcels. They may either be kept in metal-cases or put on shelves covered by doors. The price would not exceed £900 delivered here, as the tin-lined packing cases, freight, insurance and agency expenses would not exceed £100, and perhaps be less. The transit and the payment would of course be effected through the Agent General in London. Allow me to add that I feel persuaded of not a single member of the Legislative Assembly objecting to the acquisition of such unique treasures of permanent value by the Colony of Victoria if the honorable members of the Ministry would place the sum of £900 (as a not recurring item) among the miscellanea kindly on the estimates. [Mueller's underlining]

The Government of Victoria had been finally persuaded to purchase Sonder's herbarium. Parliament approved the expenditure of £900 for its purchase, of which £800 was to be payed to Sonder's widow with the remaining £100 covering packaging, freight and insurance costs (Mueller 1883b, Agent General 1883).

Subsequent reports to the Chief Secretary's office (Mueller 1883c,d,e, 1884) were concerned with details of payment, the handling and arrival of the herbarium, and the annexe that was built to house it. On 14 November 1883 Mueller (1883e) reported 'that the annexe to the bot. Museum is now completed, and that yesterday the 38 cases of the Sonderian Collection were placed there by the Stores and Transport Department. So soon as the repositries will be ready for the furnishing of which the public works Department is now making arrangements, I shall be able to commence the unpacking and give then and after the sorting and arranging is completed a fuller account of the contents of this large collection.'

Regrettably any such account by Mueller of the herbarium's content has not been located. But the herbarium had arrived at Melbourne — just 24 years after Mueller's initial request for its purchase!

Content of Sonder's herbarium at MEL

Sonder's herbarium was enormous. Mueller (1891), in a letter to H. G. A. Engler, suggested that MEL had 750,000 specimens, 250,000 of which were part of Sonder's herbarium. The following year, in a letter to J. Agardh, he (Mueller 1892) stated that MEL had approximately one million sheets, one third of which were bought from the Sonder estate.

A detailed account of the contents of the herbarium has still to be published. However, Court (1972) reported on its general content, noting that it embraces all major plant groups within the cryptogams and phanerogams and contains thousands of autographic specimens. He suggested that the algal component was probably the most important part of the collection, containing autographic specimens, not just of Sonder, but notables such as C. A. Agardh and W. H. Harvey. Other important collections include several thousand specimens from J. G. C. Lehmann (including 800 sheets of Boraginaceae) and a large collection of South African and South American plants. The latter component contains thousands of specimens connected with C. F. P. von Martius's *Flora brasiliensis* (Anderson 1971). From an Australian perspective it was an important purchase because of the addition of further Ludwig Preiss specimens and the return of specimens transmitted to Sonder by Mueller.

Nordenstam (1980) drew attention to the fact that in 1875, during the curatorship of N. J. Andersson, the Swedish Museum of Natural History (S) acquired much of Sonder's South African collection. He also noted that a substantial set of Sonder's South African specimens exist in MEL. Nordenstam suggested that Sonder had put duplicates aside for Mueller when he prepared that part of his herbarium for removal to Stockholm. Perhaps such an action did take place but in a letter to A. P. de Candolle, three years before MEL purchased the bulk of Sonder's herbarium, Mueller (1880) drew attention to the fact that not only did he have Ecklon's collection of German plants but also a large part of his South African collection ('toute sa collection d'Allemagne, ainsi que la pluspart de cette du Sud de l'Afrique'). Similarly he noted that he had southern African specimens gathered by Zeyher and, from Sonder, a large collection of monocotyledons. Some Ecklon and Zeyher collections were acquired by MEL in 1863 as a part of Steetz's herbarium (Short & Sinkora 1988) but evidently the majority, as shown by labels in his hand, came via Sonder (Mrs D. Sinkora, pers. comm.). The evidence suggests that the three cases of specimens received from Sonder in 1870 contained Ecklon and Zeyher collections.

Politicians, Mueller and the Sonder herbarium

Why was there such a long time lapse between Mueller's first request to purchase Sonder's herbarium and its acquisition in 1883? To seek an answer to this question it is necessary to realize that Mueller was not only Government Botanist but, for some time, was also the Director of the Melbourne Botanic Gardens and the Zoological Gardens. It is also necessary to assess the opinions that Mueller's bosses, the politicians, had of both him and scientific research. To do this sessions from Victorian parliamentary debates, for the years 1859–1883, have been examined.

In 1857, when he became Director, Mueller had under his control, not just the botanic gardens, but also an area encompassing the Domain and Government House reserve. Mueller introduced a series of planting schemes, including experimental planting programmes and developed, among other things, a formal systems garden (Pescott 1982). However, after 1864 there was considerable discontent with Mueller's handling of the development of the gardens. Mueller's concept of a garden, one with a scientific and educational role, did not incorporate sweeping lawns, amenity beds and beautiful vistas: it was not the botanic park desired by the public. Perhaps as a result of the public outcry William Ferguson, a regional inspector of forests, was appointed as 'Curator of the Botanic Gardens and Inspector of Forests' in 1869 (Pescott l.c.). There was considerable conflict between Mueller and Ferguson and in August 1871, during parliamentary debates concerning the gardens, there were accusations that Mueller had at one stage hid in the shrubbery to listen to a private conversation between Ferguson and a third party. Mueller was also accused of failing to render assistance to an ill person taken by Fergusson to the botanic museum. However, various politicians expressed general approval of Mueller. One suggested that Ferguson should be transferred 'to another scene of action, where he would not interfere with the proceedings of Dr Mueller, a gentleman who, although perhaps absurdly sensitive as to what some people cared nothing at all about — empty honours — had nevertheless rendered the most important services to science' (Victorian parliamentary debates 1871, p. 982).

With regard to Mueller's scientific services similar sentiments were expressed about a year later when it was proposed that Mueller should be given exclusive control of the 78 acres forming the Botanic Gardens, with the Domain being handed over 'to a competent landscape gardner'.

A more or less favourable response to Mueller at this stage is not surprising. For his scientific achievements he had gained, in 1867, an hereditary Barony from the King of Württemberg. But not all members were happy with Mueller, as shown by the following citations from Messrs Johnstone, Vale, Hanna and Cohen respectively (from Victorian parliamentary debates 1872, pp. 1208–1210):

> Whatever Baron von Mueller's scientific abilities might be, the Botanic-gardens were in a condition disgraceful to a man with any pretensions to science. . .their appearance was in no way creditable either to Melbourne or to the colony at large.

> The baron was a first-rate botanist, but an absurd and crochety man in reference to landscape gardening.

> If Baron von Mueller had paid as much attention for the last 10 or 15 years to his duties as he had for the last few days in looking after members of the House, he would have done far more good to the country. He had observed the baron flying about like a will-o'-the-wisp, and moaning and groaning to Members of Parliament. . .If he had charge of him, he would have dismissed him . . . Baron von Mueller had had his way too long.

> The baron wanted supreme command and would brook no control. If he could not have his own way, he tried to make out that he was a ruined man.

In the same debate Mr McLellan, a supporter of Mueller's (Victorian parliamentary debates 1872, p. 1210), said that:

> The baron was a very good advocate of his own interests, and that, if he saw the baron coming along a street, he would turn back rather than meet him. At the same time, he objected to Baron von Mueller being treated in a way similar to that which had driven from the colony some twenty gentlemen whose talents could not be appreciated here, though they were appreciated elsewhere.

Another advocate of Mueller's, Mr Phillips, expressed similar sentiments in the following passage (Victorian parliamentary debates 1872, p. 1213):

> The other night, when the galleries were cleared, the honourable gentleman at the head of the Government so far forgot himself as to imitate Baron von Mueller's broken English. . .It was unworthy of [the] Chief Secretary [J. G. Francis] to carricature a man possessing the high scientific attainments and European reputation of Baron von Mueller.

In June 1873 Mueller lost his position as Director of the Botanic Gardens (Pescott 1982) but retained the position of Government Botanist. In February 1876, when considering the vote for the Government Botanist, there was considerable discussion on the value of Mueller's work and reference was made to Mueller's dismissal from the directorship of the gardens. Many seemed to be impressed by Mueller's scientific achievements. Exceptions again included Mr Hanna (Victorian parliamentary debates 1876, p. 2326) who

> trusted that the Government would consider the propriety of at once and for ever laying this infernal ghost of Baron von Mueller, which for a very long time past had turned up every year in the most disagreeable form possible. . .Baron von Mueller might gain sufficient brass buttons and leather medals to fill a wheelbarrow, but, in his (Mr Hanna's) opinion, it was an an absolute fraud on the country to retain him in any capacity.

In August of the same year the Chief Secretary, Mr J. A. MacPherson, was asked what the country would gain by employing Mueller at £800 per annum. In reply MacPherson alluded to the high standing of Mueller among the learned societies of Europe and expressed the wish 'that Victoria, in the pursuit of wealth, would not altogether forget the highest branches of knowledge which indirectly benefited to the country to a very large extent, although the result might not be seen directly' (Victorian parliamentary debates 1877, p. 499). Another member called for an explanation as to why the vote to the government botanist's department had increased on the previous year. In reply, Mr D. Gaunson, member for Ararat, noted that (Victorian parliamentary debates 1877, p. 499):

> One of the chief duties of Baron von Mueller appeared to be to produce a work on Australian plants which was distributed among a few societies and also among Members of Parliament, who as a rule, religiously pitched it upon the fire, for the reason that they were unable to understand it, and took not the slightest interest in it. Possibly it was one of the very best advertisements for Victoria that there was such a great scientific gun in the colony as the Baron. From that point of view, and after the nice little speech from the Chief Secretary as to the value of the

Baron's services was it not desirable that he should be paid a decent salary.

Mr J. Woods, member for Collingwood, reminded parliament that the colony was in some financial difficulty. He (Victorian parliamentary debates 1877, p. 500) further added that:

> He had heard a great many vague statements as to the inestimable value of the department of the Government Botanist, but he could not see that it was of the slightest practical value in the colony. What plants were there in the colony which they did not know? He was speaking in a commercial sense. He quite admitted the great scientific attainments of Baron von Mueller, and the value of what the Baron might do to spread scientific knowledge, but to keep the department for that purpose, was in the present circumstances of the colony, a luxury which Victoria could not afford. He would therefore suggest that the Chief Secretary should transfer the whole of the department of the Government Botanist to New South Wales, the Government of which colony had a surplus. . .of money, and, consequently, could afford to maintain a department of this character.

Mueller retained his position and in 1883 he was again mentioned in parliament. On 10 April Mr J. Harris drew attention to the item of £900 for the purchase of Sonder's herbarium. He asked the then Chief Secretary, Mr G. Berry, what assurance had he of the value of the collection. Berry stated that the item had been placed on the estimates following the recommendation of Mueller and that, although he personally was 'inclined to strike out the item. . .in the interests of science, he held his hand' (Victorian parliamentary debates 1883, p. 161).

The aforementioned parliamentary records reflect a number of aspects which affected Mueller's chances of procuring the Sonder herbarium. During the 24 year period there had been changes in both government and ministers responsible for his department. The long term development of accord between departmental heads and ministers is not enhanced in such situations. The Colony of Victoria was also expanding rapidly. It is not difficult to see that instead of funding the purchase of a dried plant collection a government would be more likely to fund works which were seen to be critical for future development. This is particularly so in times of economic hardship — as alluded to in a statement above. It is also evident that Mueller was not just a successful scientist. He was also successful at antagonizing politicians: an achievement which would not have helped him win additional funding for any projects. Finally, the records suggest that, despite the statement that Sonder's herbarium was purchased 'in the interests of science', many Victorian politicians did not appreciate pure scientific research. And, if they did, in most cases it was probably more likely a result of Mueller's overseas standing than an appreciation arrived at through their own assessment of his work.

Conclusions

Initially, when compiling this paper, I only planned to alert the taxonomic community to the importance of purchased herbaria in MEL, providing notes on their purchase date, price and content. Such knowledge can be most valuable to taxonomists wishing to locate autographic material and select lectotype specimens and needs no further comment. However, I also became intrigued as to why Mueller should have had so many problems acquiring Sonder's herbarium. The findings came as no surprise. Today, as in Mueller's time, taxonomic research is not funded as well as most botanists would like. And, the career structure for research scientists is virtually non-existent in some public service departments throughout Australia. Pure research is not actively encouraged. Such a situation is partly the result of the down turn in Australia's economy but also reflects an ever present lack of appreciation of the utility of our science by many administrators and politicians. This is a strange situation when it is considered how conservation issues figure so highly in today's politics. (Who better than taxonomists to comment on rare and endangered species?)

However, rather than criticize politicians, we botanists should ask ourselves a question. Do we adequately promote ourselves?

The Australian Systematic Botany Society Inc. (ASBS) was a founding member of the Federation of Australian Scientific and Technological Societies (FASTS), a society formed three years ago to enhance communication between scientific and technological communities, governments and the public. It remains to be seen just how effective FASTS is in achieving its aim, but ASBS's membership of the society was a positive step forward. However, plant taxonomists comprise a small proportion of Australia's scientific community. I suspect we have a low profile even in this community. We must enhance our standing.

I suggest that ASBS should be the vehicle for promoting taxonomic botany through two further avenues. Firstly, the media. We need to be more outspoken, and what better way than to publicly comment on issues such as conservation. Many members of ASBS are professional botanists and tend to hold common views on this topic. Secondly, we must consider publishing popular accounts of our work. The society has been involved with the publication of several excellent works but, perhaps with the exception of the *Flora of central Australia*, they have been directed at the scientific community. If we don't take the initiative then we cannot expect an improvement in the funding of taxonomic botany.

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The history of the herbarium, School of Botany, University of Melbourne

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Abstract

The herbarium of the School of Botany, University of Melbourne, is large by Australian university standards, and comprises some 100,000 specimens representing all major plant groups. Beginning with the donation of H. M. R. Rupp's Angiosperm collection (excluding orchids) in 1926, it has grown with the input of diverse collectors. This paper traces the herbarium's development from Professor A. J. Ewart's time to the present day, and records his contribution and that of H. B. Williamson, W. H. Nicholls, E. I. McLennan, E. J. Sonenberg and others in the making of a significant botanical resource.

Herman Montague Rucker Rupp (1872–1956) was born on 27 December 1872 at Port Fairy, Victoria, and spent his early years there and at nearby Koroit (Rupp 1926a; Willis 1956; Gilbert 1988). When 11 years old he was sent to the Junior Grammar School, Geelong, and a year later to Geelong Church of England Grammar School. It was during these school years that his early interest in natural history became firmly established. Many years later he wrote: 'I began to collect specimens of wild flowers at the age of about 17, when I was a boarder at the Geelong Grammar School. The name of the headmaster of those days, Mr J. Bracebridge Wilson — an uncle of mine by marriage — needs no introduction in botanical circles, and to him I owe my earliest knowledge of native plants' (Rupp 1926a). Bracebridge Wilson (1828–1895) was headmaster at Geelong Grammar for 32 years and is probably best remembered for his contributions to the study of marine algae.

Rupp went on to win a scholarship to Trinity College at the University of Melbourne studying Theology, and while there won the Wyselaskie scholarship in natural science; he graduated B.A. in 1897. During this period at university he gained some knowledge of the flora of the outlying suburbs of Melbourne, and in the vacations explored the various districts where his father was Anglican Vicar — Coleraine, Buninyong, and Kingston. The extent of his interest in plants is measured by a remarkable series of catalogues he compiled for these areas (Fig. 2). Some of these (e.g. for Merri Ck, which is now surrounded by suburbs), represent valuable early records. His most memorable holiday trip was to the Riverina in N.S.W. where, during the summer of 1894–5, he spent three months with his sister who was living at Hay. Rupp records that 'It happened to be a good season with bountiful summer rains, and I found much to interest me' (Rupp 1926a).

He continues: 'Upon leaving the university I went to Beeac on the north of Lake Colac, where I advanced through the stages of lay-reader, deacon, and priest in the Anglican ministry. A more unpromising field for a botanist could scarcely be imagined, almost the whole area being occupied by dairying and agricultural farmers' (Rupp 1926a). He does not say if he found it more promising for his ministry.

During the next 40 years Rupp was stationed at a number of different localities, mostly in N.S.W., although he did spend a few years in Tasmania and made occasional trips to Victoria (Fig. 3). He pursued his botanical hobby with vigour whenever possible and became a most competent botanist, a prolific correspondent, and a meticulous recorder of his observations. Arriving at Tamworth in 1903 he began to collect more systematically, and finding so many unfamiliar forms, sought assistance from J. H. Maiden, then Government Botanist of N.S.W. Rupp writes: 'of Mr Maiden's unfailing help and encouragement over the next 20 years or so I can only speak in terms of the deepest gratitude' (Rupp 1926a).

Rupp did not immediately specialize in the orchids, for which work he is best known. Of Copmanhurst during the period 1909–11 he says: 'the epiphytic orchids were numerous and interesting, but it was not until later that the fascination of these constrained me gradually to concentrate on them and their terrestrial relatives' (Rupp 1926a). In fact it was in 1924 that he finally decided the Orchidaceae would be his major concern, and he came to the decision to donate the rest of his collection to the University of Melbourne. This was also the year of his first publication, and he went on to write some 215 articles, and two books on the orchids of NSW (Willis 1956).

Rupp at first offered the collection to his old college, Trinity, in order to honour what he felt was a commitment made some 10 years earlier to the warden of the time, Dr A. Leeper. There followed a delightful and gentlemanly correspondence between Rupp and the current warden, Dr J. C. V. Behan, during which it transpired that the college, not having the room or facilities to house the collection, suggested that the offer be transferred to the University. Behan makes some interesting observations and was something of a prophet: '. . .in the light of the fact that Melbourne

Fig.1. H. M. R. Rupp as a young man. (Photo courtesy of Mr M. D. de B. Collins Persse, Archivist at Geelong Grammar School, and Dr L. A. Gilbert.)

(University) has no such collection, if it were housed at Trinity it would merely mean that a large number of students not connected with the college would be continually resorting to Trinity in order to make use of it, and that it would be much more practical to have the collection in some central place where it would remain under expert supervision. Furthermore that the creation of such a nucleus would probably lead the University to add to it extensively, whereas if it remained in one college the prospects of such a development would be rather problematical' (Behan 1925). This prophecy was accurate, despite some lean times along the way.

Behan took a personal interest in the fate of Rupp's collection and was in touch with the first Professor of Botany at the University, Alfred James Ewart (1872–1937), over the wording of the inscription on the small brass plate commemorating the donation. It was Behan who informed Rupp when the collection arrived at Melbourne. Behan later wrote to Rupp on 7 August 1926 to say that, on Professor Ewart's invitation, he had visited the University to inspect the cabinet in which the herbarium would be housed. He described the cabinet in some detail and included the attached inscription. He suggested to Rupp: 'On the whole I think you would be very pleased with the way in which the Herbarium is to be housed, and even

Fig. 2. Plant catalogues compiled by the young H. M. R. Rupp.

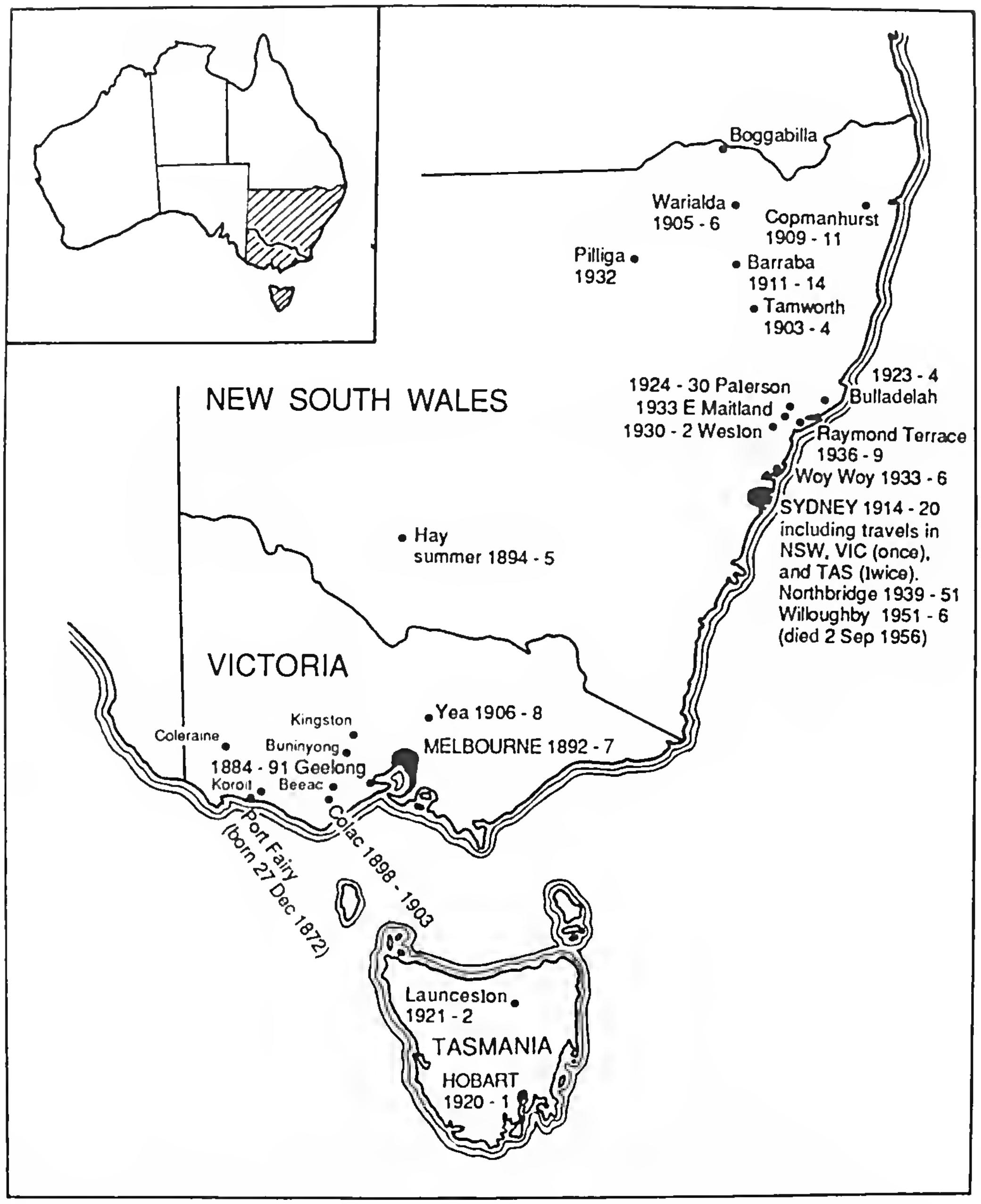


Fig. 3. Locations of H. M. R. Rupp's parishes etc. in SE Australia. Boggabilla on the Queensland border was the northern-most extent of his travels in the extensive parish of Warialda. Northbridge and Willoughby are suburbs of Sydney. (Compiled from Rupp 1926a, Willis 1956, and Gilbert 1988. Where differences occurred in dates or spellings of place names, those of Rupp are followed.)

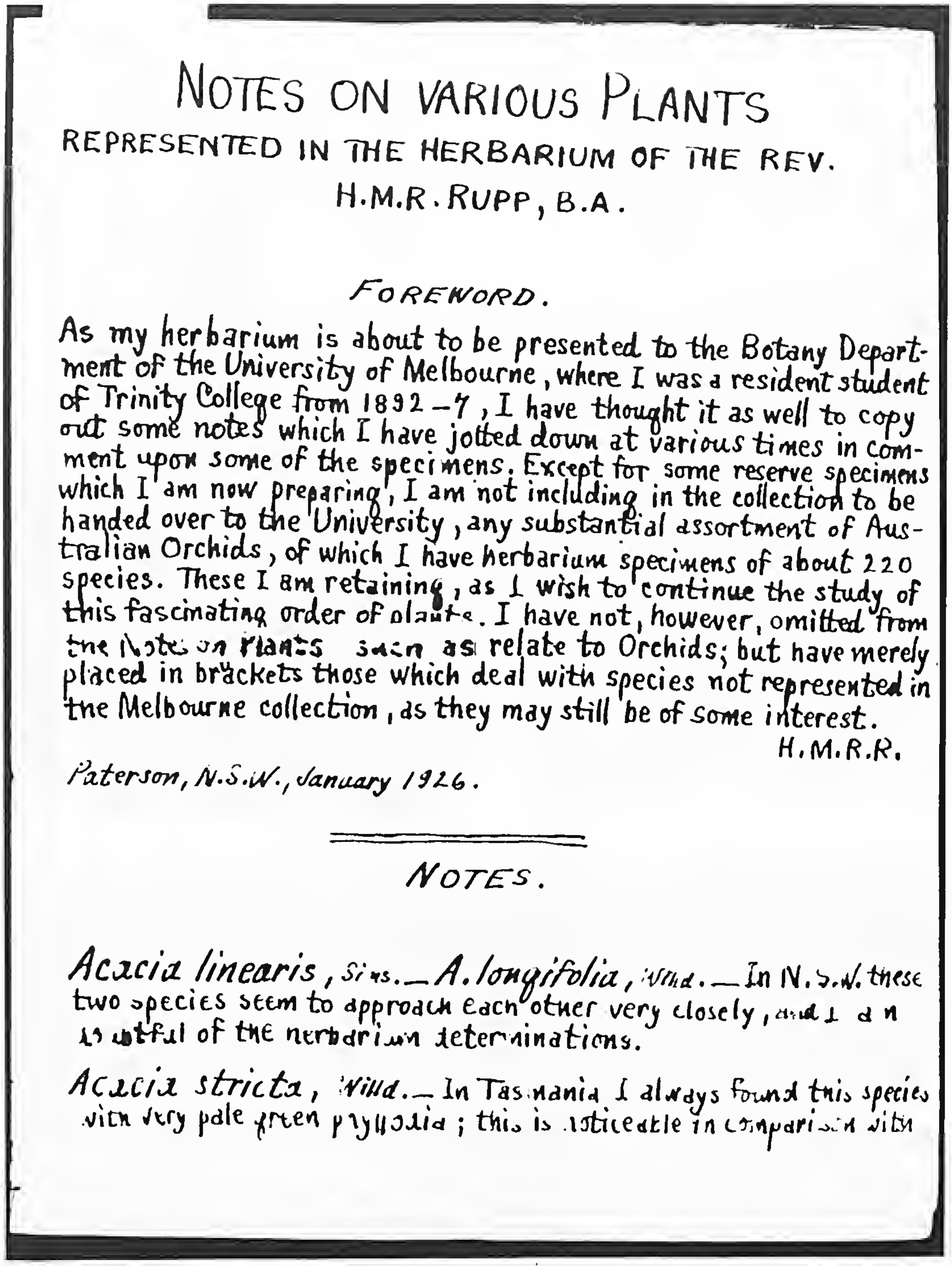
more so at the obvious pride and delight which Professor Ewart's assistant felt in speaking of the matter' (Behan 1926). Rupp's reply included the comment: 'Perhaps I ought to be — but I am not — too modest to confess that I am very pleased to know how the gift is appreciated' (Rupp 1926b). Unfortunately the identity of Ewart's assistant remains in doubt.

Much of Rupp's notes and correspondence is enlivened by his wry sense of humour, although sometimes it is rather irreverent. In his manuscript entitled 'Notes on various plants' that accompanied the donation of his collection (Fig. 4), he writes under *Pterostylis*: 'The number of species of these Orchids appears to increase annually. The differences between some of them are slight and I sometimes wonder whether specific rank, like titles, is not being given away too freely. I have an idea which is possibly absurd — and possibly not — that the general appearance and habit of a plant should count for more than they do. But I may be a heretic' (Rupp 1926a). Rupp was acquainted with 37 species of *Pterostylis* when this was written. Over 60 species are currently recognized (Baines 1981).

Rupp's specimens, numbering between three and four thousand, duly arrived in January 1926 in two large wooden packing cases each measuring about three feet by four feet by 18 inches. The Botany School Herbarium had indisputably begun, although the official starting date is recorded as 1929 coinciding with the opening of the Botany building.

Conclusive evidence of the existence of a herbarium in Ewart's department prior to Rupp's donation has not been found although it seems likely, and human memory and circumstantial evidence support this view. This is in conflict with Behan's comment to Rupp that such a collection did not then exist. Perhaps existing specimens were not seen as constituting a recognizable herbarium.

Two groups of specimens still in the herbarium support the existence of a pre-Rupp collection, based on the dates recorded on the specimen labels. It cannot be



NOTES ON VARIOUS PLANTS
REPRESENTED IN THE HERBARIUM OF THE REV.
H.M.R. RUPP, B.A.

FOREWORD.

As my herbarium is about to be presented to the Botany Department of the University of Melbourne, where I was a resident student of Trinity College from 1892–7, I have thought it as well to copy out some notes which I have jotted down at various times in comment upon some of the specimens. Except for some reserve specimens which I am now preparing, I am not including in the collection to be handed over to the University, any substantial assortment of Australian Orchids, of which I have herbarium specimens of about 220 species. These I am retaining, as I wish to continue the study of this fascinating order of plants. I have not, however, omitted from the Notes on Plants such as relate to Orchids; but have merely placed in brackets those which deal with species not represented in the Melbourne collection, as they may still be of some interest.

H.M.R.R.

Paterson, N.S.W., January 1926.

NOTES.

Acacia linearis, Sims. — *A. longifolia*, Willd. — In N.S.W. these two species seem to approach each other very closely, and I am doubtful of the herbarium determinations.

Acacia stricta, Willd. — In Tasmania I always found this species with very pale green phyllodia; this is noticeable in comparison with

Fig. 4. Page 1 of H. M. R. Rupp's handwritten manuscript that accompanied the donation of his specimens to the University of Melbourne. As well as the 'Notes on various plants', it includes a list of localities, notes on the growth of his collection, species of interest in various parishes, lists of local plant names and contributors to his collection, and notes on plant distributions.

assumed however that they have always been held in the Botany School.

The first of these are a few Central Australian specimens collected in 1902 by Walter Baldwin Spencer (1860–1929). They bear original labels from the National Herbarium of New South Wales. Spencer was appointed Professor of Biology at the University of Melbourne in 1887. While best known as a zoologist and for his studies in anthropology based on travels in inland Australia (Mulvaney & Calaby 1985), he was also concerned that botany should receive due attention. In the preface to an introductory botany text written by two of his staff (Dendy and Lucas 1892) he stresses the need for increased botany teaching and commends the book for its emphasis on the Australian flora.

Coming from Oxford, Spencer found that Melbourne University lagged behind the best British universities in the practical teaching of science and the pursuit of advanced research. This was not for lack of demand — in his first year more students undertook basic biology at Melbourne than at either Oxford or Manchester. Spencer's call for increased accommodation resulted in a new biology building on the north side of the lake. Mulvaney and Calaby (1985, p. 82) record that 'At the time the National Museum building

was the nearest neighbour, but because its collections were too valuable to be handled by students, Spencer considered that teaching collections were essential and therefore must be accumulated in the department'. It was in this building that Professor Ewart was housed from 1906 until 1929, and it would have been easy for Spencer's plant specimens to come into his possession.

The second group, a substantial number of specimens, bear original labels from the National Herbarium of Victoria. These include gatherings of many of the early collectors such as C. French (1840–1933), F. J. H. Mueller (1825–1896), F. M. Reader (?1850–1911), and C. Walter (1831–1907); the earliest that I have seen are two of Banks and Solander from the 1770s, and the latest dated 1920. The majority of these specimens appear to be duplicates prepared by J. W. C. Audas, possibly at Ewart's request. The exact timing of the specimens' arrival in the Botany School remains a mystery; it may be incorrect to assume that they came as one group. Ewart had arrived in Melbourne in 1905 to take up the appointments of Professor of Botany and Government Botanist at the beginning of the following year. Until the end of 1920, by which time the botany course at the University had grown to the extent that a full-time professor was required, he spent the mornings at the Botanic Gardens and the afternoons at the University. Ewart's dual role would have allowed the ready transfer of specimens from the State collection. Audas (1872–1959) was employed at the National Herbarium of Victoria from 1897 until his retirement in 1937.

Together these specimens form a representative sample of our botanical past, invaluable for invoking that indefinable feeling of history in those using the herbarium. I always enjoy the sense of wonder spontaneously expressed by students having opened a folder to see a specimen over a hundred years old and collected by Mueller.

Of all Ewart's scientific writings (some 156 publications), one third are concerned with the Australian flora. From 1921 onwards, when he would no longer have had such ready access to the National Herbarium, he continued to publish in the series 'Contributions to the Australian Flora' (Nos 30–36) in the *Proceedings of the Royal Society of Victoria*, and wrote the *Handbook of Forest Trees for Victorian Foresters* (1925) and the landmark *Flora of Victoria* (1931). Many members of staff and post-graduate students were involved in the preparation of these publications, including the Flora. Co-authors and assistants include E. M. Derrick, P. Jarrett, L. R. Kerr, E. I. McLennan, A. H. K. Petrie, E. J. Sonenberg, Mrs Thomson, and many illustrators. Numbers 30 and 31 in the 'Contributions' series were largely based on Ewart's collections made during field work in Central Australia in 1924. Ewart is also said to have amassed a sizeable collection during the preparation of the *Flora*, although it is unlikely that this was composed of all his own specimens. There is no conclusive evidence of such a 'Flora collection' remaining; the specimens from the National Herbarium of Victoria would be the only possibility. Relatively few Ewart specimens remain in the University collection.

The prevailing atmosphere of Ewart's department was clearly positive towards establishing relevant botanical collections, which were not restricted to herbarium specimens. Older members of staff speak with regret of the disappearance of the botanical museum, once a showpiece of the department in the rooms now occupied by the library. It seems clear that Rupp's donation must have augmented an existing collection, whatever its size and content, and been the catalyst for the recognition of the herbarium in its own right.

Efforts to locate early departmental files of Ewart's time up to 1933 have failed and we have little record of day to day activity associated with the herbarium.

Presumably it was Ewart's initiative to establish the position of Honorary Keeper of the Herbarium, a post first held by H. B. Williamson (1860–1931) who was a schoolmaster and early botanical pioneer in Victoria (Willis 1949b). Williamson retired from full time teaching in 1925 and was appointed to the part-time position of Keeper four years later; he held the post until his death in early 1931. He was an active member of the Field Naturalists Club of Victoria and widely regarded as a committed educator.

In a letter quoted in the Victorian Naturalist journal of April 1931 (p. 203) he wrote: 'The importance of a position nowadays is gauged by the money hanging to it, and people are apt to look askance at anyone who does a job for the Government or an institution like the University for no fee. I've had several say, 'What are you getting out of it?' I welcome the appointment to the University because it will give me more scope for passing on advice and material gratis'.

He attended the University once a week and his initials on many herbarium specimens bear witness to this time. Although he and Ewart 'didn't get on particularly well' (E. J. Sonenberg, pers. comm.), Williamson is acknowledged as providing the account of the whole of the Leguminosae and for partial revision of the manuscript and proofs for Ewart's Flora of Victoria published in 1931.

Following Williamson the Honorary Keeper's position was taken up, apparently in 1933, by W. H. Nicholls (1885–1951) another spare-time botanist who left an enduring legacy (Willis 1949b, 1951). Nicholls worked as a bookbinder and later at the Footscray gardens and is well known in botanical circles for his monumental work *Orchids of Australia* (1969) finally published after his death. He travelled widely throughout the State and contributed many specimens to the collection. His exact period as keeper is unclear but letters to Ewart reporting some of his travels and collections exist up to mid 1936. Nicholls signed his letters as Honorary Curator — it seems these titles were used interchangeably.

Towards the end of Ewart's time, a forester stationed in the north west of the state, W. J. Zimmer (1898–1967), established contact with the department regarding his study of the flora of that region. Zimmer made a systematic collection of the mallee flora as part of his pioneering survey published in 1937. His work correlated vegetation types with soils as well as providing the first detailed plant census for the north west.

Zimmer's collection comprises nearly 700 specimens and includes a number of interesting early records. Old correspondence notes such discoveries as 'No. 658 *Pachycornia tenuis* — new record for the state', and 'No. 667 *Scaevola depauperata* — new

record for Victoria'. Lamentably, most of the specimen labels simply give Mildura as the locality, but in some cases a more accurate guide is given in the correspondence.

Zimmer's contributions spanned the end of Ewart's professorial reign (he died in office in 1937) and the beginning of that of the plant physiologist Dr J. S. Turner.

The few records that exist with respect to the herbarium during Professor Turner's term of office (1938–1973) such as acknowledgements of gifts, and notes of staff changes, paint a rather bland picture. The department was expanding and the prevailing atmosphere changing. Members of staff held strong views as to the nature and suitability of an herbarium for the Botany School. A recurrent feeling was that the herbarium should include strictly teaching material of Victorian species only, and locality collections useful in the preparation of excursions. Space for research collections after their immediate relevance was over, would not be made available. This feeling reached its height during the tenure of Dr R. L. Specht as reader in the first half of the 1960s. He brought a strong ecological emphasis to the teaching of systematics, and plant collections were to include detailed ecological data on all specimen labels. A comprehensive series of specimens from Lake Mountain remain as his most tangible contribution.

Many specimens were removed from the department during the ten years or so after Ewart's death. Some of Rupp's NSW specimens have been relocated at the National Herbarium of Victoria. Much material was discarded (S. C. Ducker, pers. comm.) and but for the support of other members of staff, notably Dr McLennan, Mr Sonenberg, Dr Ducker and Dr Ashton, the collection might well have languished.

Dr Ethel McLennan had taken a more and more active hand in the running of the department in the later years of Ewart's term, and was Associate Professor from 1931. Her career in the Botany School spanned well over 50 years and she provided considerable support for the herbarium.

Ethel Irene McLennan (1891–1983) was born at Williamstown, Victoria and received her early education at Tintern Ladies College, Hawthorn. She later attended the University of Melbourne, graduating B.Sc. with first class honours and exhibition in 1914. She was appointed as demonstrator-lecturer in the Botany School in 1915, undertaking a full programme of teaching, and starting work on her first scientific publications. For her detailed study of the endophytic fungus associated with the rye-grass, *Lolium*, she was awarded the degree of D.Sc. in 1921 (Turner, 1983).

The main fungal herbarium numbering some 2,000 specimens was almost entirely accumulated under her direction. In a letter to C. G. Hansford at the Waite Agricultural Research Institute in 1952 she commented that: 'Our collection of fungi in this herbarium started with me...'. It obviously began a long while before the date of the letter; in September 1937 Ewart wrote to the chairman of the University finance committee requesting that additional storage be made available in the herbarium, mainly for the fungal collection. Dr McLennan was in touch with many of the prominent mycologists of the time — parcels of specimens were despatched regularly — and the herbarium received the benefit of their expertise. Two of the more significant aspects of the collection are the gasteromycete and polypore specimens annotated by Dr G. H. Cunningham in New Zealand, and the agarics named by Professor J. B. Cleland (1878–1971).

Although officially retired in 1955, she continued working actively in the School of Botany until February 1957. This was some eight months after Miss Edith M. Packe had resigned from the position of herbarium assistant, which had followed her time at the Mildura campus of the University after the War. Miss Packe was responsible for the general maintenance of the herbarium and added numerous specimens from the Mildura area.

Seeking a replacement for Miss Packe, Professor Turner appointed Dr McLennan as 'Keeper of the Herbarium' in April 1957. This was a part-time position on a yearly salary of 300 pounds. She officially held this post for nearly 16 years and although not particularly active towards the end (by which time she was over 80 years old), she did much in the way of reorganization and general curatorial work, updating the nomenclature of the higher plants to conform to Willis' *Handbook* (1970, 1973) and establishing a sound basis for subsequent growth. She began the task of indexing and registering the entire herbarium, later completed by Mr J. Brown. The handwritten registry books bear witness to her patience and attention to detail.

It is a matter for conjecture what might have befallen the herbarium had not such an authoritative figure been at the helm for so many years. There is no doubt that the strength of the herbarium at the present time owes much to her efforts.

The encouragement given by Dr McLennan to all students, whether of the University, or amateurs, is often noted in writings documenting her career. Two striking examples of the flourishing of amateur abilities are seen in two series of paintings of fungi held in the herbarium. The first series, painted in the 1930's by Mr Malcolm Howie (1900–1936), comprises 84 plates, some of which include more than one species. These are copies executed by the artist at Dr McLennan's request; the original works are held by the artist's brother-in-law Dr J. H. Willis. Howie lived a tragically short but remarkable life in which he fought serious illness that threatened to paralyse him completely (Barrett 1936). He finally completed illustrations of some 200 species. Ewart wrote to the University registrar in August 1936 regarding the purchase of display cases for the drawings which he said 'are of considerable merit and are the property of the University'.

The second series of paintings, also of fungi, consists of over 200 working illustrations with accompanying descriptions. These were painted by Mrs Thelma Daniell in the 1950s and 60s and are mainly of the families Boletaceae and Amanitaceae (Fig. 5). Seeking recognition of their potential Dr McLennan wrote in a letter to Dr R. W. G. Dennis at the Royal Botanic Gardens, Kew, that the drawings were 'accurate and extensive', and sent copies for his use. More recently, in 1975, copies were requested by Dr R. Watling, mycologist at the Edinburgh Botanical Garden. Dr McLennan notes that Mrs Daniell began keeping specimens in October 1959. Her collections are now held in the National Herbarium of Victoria (J. H. Willis, pers. comm.); the

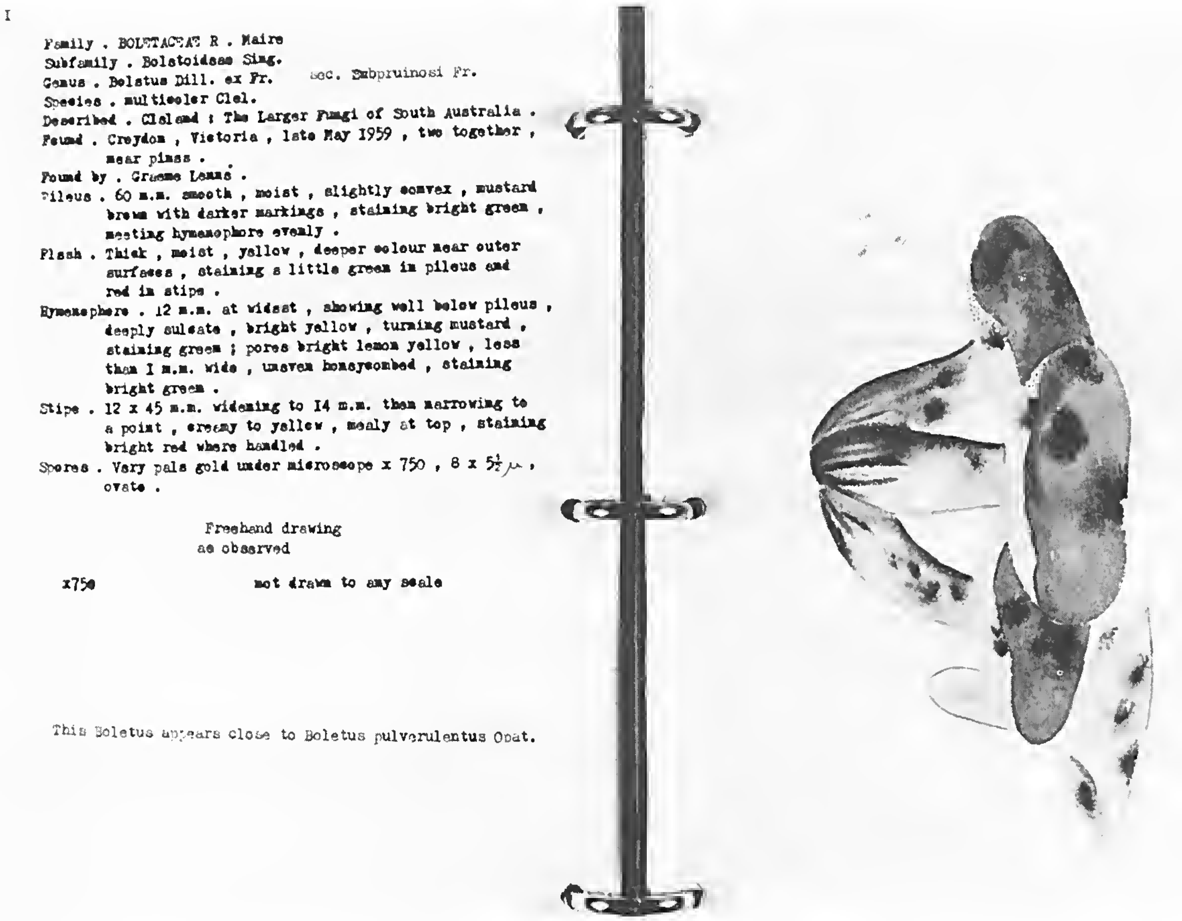


Fig. 5. Description and illustration of *Boletus multicolor* Clel. prepared by Mrs Thelma Daniell.

matching of specimens and illustrations would enhance the value of both.

In 1944 there arrived in the School of Botany someone who would later make a substantial contribution to the herbarium. Initially employed as a research assistant to Dr McLennan, Mrs Sophie Ducker completed a part-time B.Sc. degree in 1952, and the following year was appointed senior demonstrator. With Dr McLennan her work involved the maintenance of fungal cultures, including screening fungi for antibiotic activity following the discovery of penicillin, and the study of soil fungi from Victorian heathlands. Her papers on soil fungi together with her first algal work were submitted for the degree of M.Sc. in 1957. There followed appointments as lecturer, and then senior lecturer in 1961 (Rowan 1984).

Her main research field has been marine algae, particularly the siphonous green algae and later the corallines (e.g. Ducker 1967). Of significance was a substantial grant from the Melbourne and Metropolitan Board of Works in 1969 for a survey of Port Phillip Bay. Alongside this work was the establishment of the algal herbarium.

During this period she felt the need for formalizing the recognition of the herbarium and was instrumental in moves to include it in the *Index Herbariorum*, despite opposition from within the department. The School of Botany herbarium, with the code MELU, first appeared in the 6th edition in 1974, initial enquiries being made in 1965.

At the time of her retirement in 1974, the algal collection numbered some 15,000 specimens. The majority of these were from the Victorian coast and Bass Strait, with some overseas material included. Her contributions, however, are not entirely restricted to algae — numerous fungal specimens and a collection from the Bogong High Plains bear her name. The High Plains collection was part of field work spanning more than a decade that involved many members of the department under the direction of Professor Turner and Mrs S. G. M. Carr (Carr & Turner 1959). In 1978 Dr Ducker's published work was accepted by the University of Melbourne for the degree of D.Sc.

In parallel with Ethel McLennan's academic career was that of Mr E. J. Sonenberg as a member of the technical staff. He joined the University as a junior assistant in 1922, the same year as did his mentor and influence for many years, ecologist Dr Reuben T. Patton (1883–1962). (Mr Sonenberg accompanied Patton on many of his travels and no doubt assisted with the collection of his specimens. Unfortunately Patton's collection was never fully curated and those specimens that were salvaged after his death were donated to the National Herbarium of Victoria (J. H. Willis, pers. comm.). Mr Sonenberg's preferred place was very much behind the scenes; he is a most self effacing person who does not readily take credit for his considerable contribution to the department spanning over 50 years. Mr Sonenberg began collecting for practical classes when 16 and the habit took such a firm hold that, 15 years after his retirement, students are still making use of materials he amassed. He became the mainstay of systematic botany teaching for over 40 years.

Collecting for the herbarium also started early — he recalls with some embarrassment his first efforts when asked to prepare pressed specimens of succulents such as *Sarcocornia* (*Salicornia*) without any prior instruc-

tion. 'After 3 days they were rather hairy'. Many of his collections are from the inner suburbs of Melbourne and document the suburban flora, particularly the weeds. The elegant and distinctive handwriting is a notable feature of his specimen labels. With a prodigious memory, he developed an authoritative knowledge of the Victorian flora, as well as of poisonous plants and exotics, that inspired a distinguished reputation within the department and the University. During the early 1950s Mr Sonenberg received assistance from Frank M. Nathan, a returned serviceman employed as a technical assistant. Frank Nathan's most evident contributions are his specimens from the Little Desert in Victoria.

The department receives numerous enquiries on all manner of botanical matters, and Mr Sonenberg was consulted almost daily by the University community, particularly the Faculties of Veterinary Science and Agriculture, by government authorities such as the Police, and by the general public. In about 1965 he completed a paper examining the components of hair balls extracted from the gut of sheep, following a veterinarian's enquiry. This was recommended for publication in the *Australian Veterinary Journal* but never printed. Some years before his retirement in 1973 concerted efforts were made to arrange the award of an honorary B.Sc. following an initiative of Dr McLennan. Mr Sonenberg declined it, 'I was blessed with a retentive memory, that's all'.*

By the mid 1970s the pendulum of botanical interests in the department was again swinging. Professor T. C. Chambers presided over a department more inclined towards the growth and development of the herbarium. He joined the Botany School in 1961 and took up the second Chair of Botany in 1966. For the next twenty years until his resignation in 1986, Professor Chambers provided a positive influence on attitudes towards the herbarium. During this period Dr D. H. Ashton has been one of the main contributors of specimens, from many parts of Victoria. He has also collected material, specifically for teaching, from wider afield. Gaining his B.Sc. in 1949 and Ph.D. in 1956, he joined the department as lecturer in 1960. The herbarium has received a steady input of specimens — flowering plants, bryophytes, lichens and fungi — reflecting his wide botanical interests, and keen eye enhanced by the artist's capacity for observation.

Following the official retirement of Ethel McLennan from the keeper's position in 1972, the day-to-day running of the herbarium fell to Mr E. J. Sonenberg, and in 1974 to Mr J. Brown until he in turn retired at the end of 1975. In recent years the Keeper's position has been filled by Dr S. L. Duigan, and since 1975 I have undertaken the daily responsibilities.

In the last decade, considerable additions have been made to the collections. In particular, three contemporary aspects of the herbarium represent history in the making.

The moss collection

Dr Ilma Stone was a student at the University of Melbourne between 1930 and 1932 and received her M.Sc. in 1934. After two years employment she devoted the next twenty years to marriage and family responsibilities, returning to the Botany School in 1957 as a part-time demonstrator. She received her Ph.D. in 1963, and in 1969 turned her research attention to mosses. This was the beginning of a significant chapter in Australian bryology. She retired from her Research Fellowship in the School of Botany, which still involved active teaching, in December 1978, and from that time, as Senior Associate of the University, has actively continued her pioneering work. Travelling widely, with the support of her husband Alan, she has amassed a substantial collection of mosses from many parts of Australia. The publication of *The mosses of Southern Australia* with Dr George Scott and Celia Rosser in 1976 was a milestone in Australian bryological history. In almost 20 years of concentrated study she has contributed a number of revisions and published numerous papers describing 25 species, several genera and one family new to science. Since about 1980 the bulk of her moss collection, numbering more than 25,000 specimens, has been housed in the Botany School Herbarium.

The algal collection

Since 1974, Dr Gerry Kraft and his students have built on the foundation laid by Dr Sophie Ducker and established the algal collection as one of world class. The rich marine algal flora of southern Australia is extensively covered, and many other parts of the world are also represented. The taxonomy of the red algae has been a major line of research and the last fifteen years have seen over fifty new species described, with many more the subject of current research. The work of Dr Tim Entwisle represents a pioneering study in the documentation of Victorian species of freshwater algae, particularly those of the Yarra River catchment. His 800 specimens constitute the first systematic collection of this neglected group.

The fungal collection

Two mycologists, one amateur, one professional, have contributed to the growth of the fungal collection.

The recent death of Gordon William Beaton will be felt by mycologists around the world. His detailed studies as a gifted amateur mycologist have gained him an international reputation.

Born at Lismore, Victoria, on 14 June 1911, he received his early education at Boorcan, (near Camperdown), and at Noorat and Terang. He left school when 14 years old to work in a local bicycle shop, and later became a motor mechanic and garage proprietor. He retired in 1972 to Eildon in central Victoria.

Beaton was a first class marksman with a rifle and represented Victoria on a number of occasions. Through this interest he met H. T. Reeves (1894–1963), a keen field naturalist, photographer and illustrator who introduced him to photography of botanical subjects. Initially attracted to the cup fungi, his frustration at the lack of references for their identification provoked his serious interest. He received advice and support from Dr McLennan and Dr Jim Willis, and from Dr R. W. G. Dennis of the Commonwealth Mycological Institute at Kew, England. Many of the fungi he collected had not been described. As mycology became his major interest, he acquired a good microscope and built up an excellent library of fungal literature. The centre of his interest moved over

* Ed. note: E. J. Sonenberg died on 5 April 1989.

the years from the Helotiales and Pezizales to the hypogeal Gasteromycetes which were not well known.

In the last ten years, Gordon Beaton and his colleagues have published some thirty-five papers and named more than forty new species. Although he has described himself as 'not a collector' there are Beaton specimens in mycological collections in many parts of the world. The bulk of his material he kept at his home — in response to a questionnaire in 1980 he recorded the size of his collection at some 650 specimens — MELU held about 180, including over 25 types. He died on 2 April 1988 and his collection has now been donated to the Botany Herbarium.

Dr Haring Swart joined the staff of the Botany School in January 1966, having worked previously at the University of Witwatersrand in Johannesburg, South Africa. He came with a background in mycology and had studied South African soil fungi, particularly those of mangrove communities. In Australia he turned his particular attention to leaf-inhabiting fungi which were virtually untouched by previous taxonomists. The systematic study that was to occupy the next 22 years, produced a series of 30 papers on leaf-inhabiting fungi including descriptions of many new taxa. An outstanding feature of his work is the accompanying illustrations — he is one of the finest mycological illustrators. Examples of his drawings can be seen in the series of papers on Australian Leaf-inhabiting Fungi published in the *Transactions of the British Mycological Society* (e.g. Swart 1986a, b).

The majority of his type specimens are at the Biological and Chemical Research Institute at Rydalmere in NSW (DAR), and the remainder of his collection at MELU. It includes numerous microscope slides and drawings of Kew specimens prepared while on study leave in England in 1975, as well as some 400 specimens accumulated up until his retirement in 1987.

Conclusion

Historical papers such as those of J. H. Willis on Botanical Pioneers in Victoria (1949a,b,c), document the involvement of enthusiastic amateur botanists as well as professional workers. The School of Botany Herbarium likewise reflects the input of amateur and professional. It would be much the poorer without the work of amateurs such as Rupp, Williamson, Nicholls, Howie, Daniell and Beaton placed alongside that of their professional colleagues. In the case of the illustrators Howie and Daniell the value of their contribution has not been fully exploited. Without herbaria as storehouses for such work it is difficult to see how the efforts of these people would not be dissipated and fragmented with a consequent loss to the botanical cause.

In April 1977 while working on the genus *Pultenaea*, Mrs Margaret Corrick (then at the National Herbarium of Victoria) identified a number of valuable specimens in MELU including syntypes previously unrecognized. This reflects badly on previous ill-conceived actions in discarding material without due thought for the future. What may have been lost?

It is not easy to evaluate the smaller institutional herbaria but they play an important role; a herbarium of the size and historical interest of MELU, representing the accumulated efforts of trained botanists and knowledgeable amateurs over more than sixty years, is irreplaceable and invaluable. It is a small piece in the unfolding jigsaw that is Australian Botany. Each piece has its allotted place.

This paper does not present the complete story; time for extensive research spanning years was not available. The omission of any contribution is not based on a judgement of value.

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History of early Western Australian herbaria

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Abstract

Early official herbarium collections in Western Australia date from the 1890s when both the Museum and Department of Agriculture are thought to have been active. Most early collections left the state, but by 1916 the above organisations had been joined by the Forests Department in gradually building up independent collections of pressed specimens. The decision was made in 1928 to merge the three herbaria into a single State Herbarium. This was finally fully implemented in 1959 and the name changed to Western Australian Herbarium in 1970.

This paper traces the history of Western Australian herbarium collections, official and private, as well as the botanists associated with them, prior to the formation of the official State Herbarium in late 1928 or early 1929.

Prior to the 1890s the Western Australian flora had been studied by a host of visiting botanists and explorers who made collections, firstly along the coast (e.g. Dampier 1699; Menzies 1791; Labillardiére 1792, Leschenault, Guichenot, Brown 1801; Gaudichaud 1817 & 1820; Cunningham 1817–1822; Baxter 1823–1825 & 1828–1829; Fraser 1827) and then, following settlement, further inland (e.g. Huegel 1833; Drummond c. 1829–1851; Preiss 1838–1842; Maxwell 1858–1875; Mueller 1867, 1877).

In the absence of a suitable repository in the colony, many of the above collections were sent to Europe. There was, however, an early opportunity for the government to establish a herbarium in the Swan River Colony. In a letter sent to Governor Hutt in October 1839, Ludwig Preiss (1811–1883) offered a set of his natural history collections to the British Government. The collection was priced at £3,000 and contained plant, animal and geological specimens. The plant collection contained perhaps 1,500 different species, including both cryptogams and phanerogams (Erickson 1969, McGillivray 1975). To its discredit, the Government found Preiss's terms excessive and declined his offer. Had it been purchased, Preiss's collection may have been incorporated into a herbarium in Britain. However, had it been housed in Perth, it could have formed the nucleus of a very fine public herbarium of Western Australian flora.

It was not until the closing years of the 19th century that government collections, two in fact, had their beginnings in Western Australia. The earliest general collection was probably that of the Museum which, following its establishment in 1891, began to receive interesting and useful specimens presented to it by members of the public (Anon. 1965). Presumably some pressed plant specimens would have been included among them. The Bureau of Agriculture, formed in 1894, appointed Alexander Morrison as a botanist in 1897. He doubtless began a herbarium collection of the plants which concerned him, principally poisonous plant as will be shown later.

Among the early documents which have so far come to light, precious few facts and figures have been discovered relating to the history of these embryonic herbaria. As the personalities concerned with them are a little better documented, I begin with a brief account of B. H. Woodward (of the Museum) and Morrison.

Bernard Henry Woodward (1846–1916)

Woodward, a member of a distinguished English family (Hall 1978), was Director of the Museum and Art Gallery from 1889 to 1916, during which time he periodically forwarded specimens to the Bureau (later Department) of Agriculture for determination. In a letter dated 29 July 1897 he referred to poison plant data he had collected 'three years ago' (Woodward 1897a) indicating that he was himself an active collector. An earlier letter of 25 June 1895 asked for a timber specimen accompanied by a botanical specimen or description 'to enable the botanical name to be ascertained' (Woodward 1895). In the files of the Western Australian Museum there are letters advising of the return of these specimens, or most of them. It must be assumed that the specimens were being added to a Museum herbarium: the earliest such letter is dated 25 October 1897 (Woodward 1897b).

In view of the above, a starting date of around 1894–1895 seems probable for the Museum herbarium. Since no mention is made in correspondence of any staff botanist, Woodward himself was presumably the curator. Although the Bureau of Agriculture existed at this time it seems unlikely that a herbarium would have been started much before the appointment of Morrison. Therefore, the Museum probably originated the first official State collection of herbarium specimens.

Alexander Morrison (1849–1913)

Morrison was the first person in Western Australia to be appointed to an official government position as a botanist. A retired medical practitioner, at the age of 48, he joined the Bureau of Agriculture on 1 July 1897,

* Ed. note: John Green retired from the Western Australian Herbarium on 31 Dec. 1987. Helen Cohn, Beng Siew Mahon, Bruce Maslin and I are responsible for a number of changes to the original manuscript.

at a salary of £230 per annum. Apparently he continued to perform his botanical duties until his retrenchment on 19 June 1906 (Anon. 1914). This suggests that he was in continuous employment with the Government, being one of the small staff of the Bureau absorbed by the Department of Agriculture in 1898. In curious contrast, however, is the statement made by the Secretary of the Bureau to J. J. Lee Steer M.L.A., in a letter dated 30 October 1897, that 'Dr Morrison was employed by the Bureau for a specific purpose viz., to catalogue and describe the poison plants of Western Australia for the "Settlers' Guide". This work is now completed, and Dr Morrison severs his connection with the Bureau this month.' (Secretary of Bureau of Agriculture 1897). Whatever the significance of the last sentence, Morrison evidently did not permanently sever his connection with the Bureau, continuing to serve it, and later the Department, until his retrenchment as well as afterwards as a private consultant.

Between 1906 and 1912 Morrison also undertook honorary botanical work for the Museum, mostly identifications, and made large collections of plants in the Stirling Ranges, 'at the instance of the Government' (Anon. 1914, p. 109). Whether any specimens found their way into a government collection is not known, but it seems likely that one set was added to his private herbarium which, by 1912, occupied fifty cases (Anon. 1914).

There is some confusion over Morrison's title and stipend (Serventy 1970). Despite the fact that he sometimes styled himself 'Government Botanist', even in some official reports (Muir 1901), I believe his position was only ever officially designated as 'Botanist'. The former appellation is an understandable and reasonable one for a civil servant, but the only person to occupy a position officially designated 'Government Botanist' was C. A. Gardner, between 1929–1960. On the question of Morrison acting in an honorary capacity, there is abundant evidence that he drew a salary from the Department of Agriculture between 1897–1906, and received botanical consultant fees afterwards, although he may have acted in an honorary capacity at the Museum.

Morrison was an admirable person to occupy the role of first botanist: he is said to have been painstaking, kindly, scrupulously honest and an indefatigable collector (Anon. 1914). It is regrettable that he suffered the ignominy of being retrenched and his position rendered vacant. This was presumably to effect necessary economies but perhaps was also a result of his falling out of favour with the administrators, as hinted in the rather peremptory 'Dr Morrison severs his connection with the Bureau this month'. Morrison took up medical practice again, in Perth, after his retrenchment in 1906, as well as performing botanical consultancy work. He continued to be active in scholarly botany, presenting a lecture 'Vegetation and Rainfall' at the Western Australian Museum (Morrison 1910), revising the official *Year Book of Western Australia*, and advocating botanical and forest reserves. It is somewhat surprising that in 1912, at the age of 64, he departed for Victoria, taking up a position with Professor A. J. Ewart at the National Herbarium of Victoria (MEL). Unfortunately he was to die only a year later.

Morrison bequeathed his herbarium to the University of Edinburgh, from which he graduated. One can only guess why he saw fit to do this, when it could have made a valuable addition to the Museum or Department of Agriculture collections, both by then well-established. However, some of the collections were returned to Western Australia (PERTH) by way of donation 60 years later while others found their way to Kew (K) and Brisbane (BRI).

Less than a month after Morrison's retrenchment Woodward asked the Museum Committee to write to the Minister for Agriculture asking for the Department's 'valuable Botanical collection' to be deposited for safe keeping in the Museum. This was done, as indicated by a return letter a year later (Anon. 1907), asking for a suspected poison plant to be compared with specimens 'from this Office, and now in your keeping'. These letters contain two most interesting points: one, that the Department of Agriculture did have a herbarium, a fact that could only be surmised on earlier evidence; and secondly, that the Museum became for a few years the sole repository of official herbarium collections, presumably under Morrison's honorary curatorship and doubtless encouraged by Woodward's interest. Tantalisingly, no evidence has been found suggesting even approximately the size of either collection at this time.

We still do not know when the Department of Agriculture herbarium was started. However, since Morrison was known as 'all his life a collector of botanical specimens' (Anon. 1914, p. 109), and since the Department's collection was described as valuable nine years after his appointment to the Bureau, we can assume that he contributed to the official collection, as he did his own, commencing the year of his appointment, 1897. Pending the discovery of new evidence, this then, seems to be the best estimate of the year the collection was started.

The emergence of two official collections in Western Australia in the 1890s, and the official appointment of Morrison as Botanist, provided a much-needed focus for collections of the local flora. Even around this time, however, significant collections were being made by visitors (Helms 1891–1892; Diels & Pritzel 1901–1902; Dorrien-Smith 1909). Most of their specimens still left the state, as indeed did those of the non-botanist state official, W. V. Fitzgerald (1905–1906). (Many collections also left the state in later years, even those gathered by public servants, such as F. Stoward and W. M. Carne, who were responsible for the state collection. Some significant collections were eventually repatriated. For example, some specimens gathered by C. R. P. Andrews were received by W. E. Blackall and came eventually to be housed in PERTH. And Fitzgerald donated a set of specimens to the Department of Agriculture, of which many duplicates went to J. H. Maiden in NSW.)

Frederick Stoward (1866–1931)

In 1911, about the time of Morrison's departure, and after an interval of five years without a botanist, the Department of Agriculture appointed Dr F. Stoward as Botanist and Pathologist. At the same time its collection of plant specimens, mainly poison plants, was retrieved from the Museum. In the meantime, the

Department's botanical work had been performed, or at least reported on, by the entomologist L. J. Newman (1910, 1911), whose botanical duties comprised mainly identifications of weeds and poisonous plants.

At the time of his appointment Stoward was 45 years of age. He had migrated to Australia 30 years before. He specialized in fermentation and chemical processes and before this appointment worked mainly in Adelaide (Hall 1978). His name appears in the Department of Agriculture's annual report for 1911–1912. The same report also contains the first clear reference to an actual herbarium: 'considerable additions have been made to the Departmental herbarium collection which, as time progresses, will be further augmented' (Stoward 1912, p. 49). Native flora, alluded to for the first time in this report, was included, along with weeds and poisonous plants.

By the following year, Stoward was able to report a 'very considerable increase in the number of plant specimens . . . received for determination', leading to 'the very necessary undertaking of re-arranging and cataloguing the collection of plant specimens which at present comprise the Departmental Herbarium . . . mainly carried out by my assistant Mr Wakefield' (Stoward 1913, p. 61). Only the vaguest indication of the size of the herbarium is given, when Woodward (1913) referred to Stoward as having charge of 'the greater part of the Government botanical collections'. Evidently, by this time the Department of Agriculture's herbarium had overtaken in size that of the Museum. (This occurred despite the fact that Stoward's own collections from Western Australia are today found in other herbaria, including BM, K and MEL, but are largely unrepresented in PERTH.)

Two further annual reports of the Department of Agriculture, covering the period up to 1916, indicate no more than quiet routine in the herbarium, still under Stoward as Botanist and Plant Pathologist. In another department, however, a new herbarium had suddenly emerged.

The forest herbarium

In 1916 the Conservator of Forests announced the establishment of a 'forest herbarium. . .placed in the hands of District Ranger Schock' (Lane-Poole 1917, p. 6). Stoward was thanked for undertaking the work of identifying the material. Of interest is the practice, begun in this report and continued for some years, of listing the botanical names of specimens collected, identified and incorporated during the year. The total for 1916 was 76 plants identified to species, as well as a handful to genus or having affinity to a named species. Somewhat similar-sized lists appeared in 1917, 1918 and 1919. However, in 1920, only 34 specimens were added to the collection as the officer in charge of the herbarium was assigned to other duties (Lane-Poole 1920, p. 8).

Desmond Andrew Herbert (1898–1976)

In 1917, Stoward left the Department of Agriculture to return to his family wine business in South Australia. At this point botanical work was placed under the Agricultural Chemist, E. A. Mann, who was 'ably assisted in the Botanical section by Mr D. A. Herbert, appointed Botanical and Pathological Assistant in May 1918' (Trethowan 1919, p. 5). The Branch was rehoused in the office of the Government Analyst in July 1918, botanical work being 'entirely transferred from the Department of Agriculture, where it had been previously housed' (Mann 1919, p.24). Despite the foregoing wording, this seems not to have involved a transfer to a different government department. The Government Analyst may have been a somewhat independent Branch, loosely called a 'Department', yet still reporting to the Minister for Agriculture.

Mann (1919) reported on Herbert's considerable achievements in the first year. In addition to routine work these included the elucidation of the parasitic nature of *Nuytsia floribunda* (Labill.) R. Br. ex Fenzl. The re-arrangement and classification of the herbarium and the establishment of a mycological herbarium were listed as requirements for 'further increasing the effectiveness of this branch' (Mann 1919, p. 24).

In the same report, Herbert, who had immediate charge of botanical work, gave the earliest known, though misleading, indication of the size of the collection: 13,000 (evidently an error for 1,300) specimens, 'mostly Western Australian species, but there are a number from the eastern States and some German species, besides specimens of those exotic plants which have become naturalised' (Herbert 1919, p. 29).

By 1920, Herbert, having now acquired the degree of M.Sc., was Economic Botanist and Pathologist and had described two new species of native plants, *Isopogon occidentalis* D. Herbert and *Xanthorrhoea reflexa* D. Herbert.

Herbert was busy again in 1921, describing new species, publishing on *Xanthorrhoea* Smith and Santalaceae, and carrying out other routine work. He was assisted, as in 1920, by Miss V. Prowse in the re-organization of the herbarium. She was combining 'the several collections comprising it' and bringing up to date their nomenclature. Herbert proudly announced that 'when this is completed, it will be the best herbarium in the State, and will contain about 6,000 specimens, many of them types' (Herbert 1921, p. 15).

Charles Austin Gardner (1896–1970)

The year 1920 was a momentous one for herbaria as it marked the appointment of Gardner as a botanical collector in the Forests Department. (Herbert had a hand in this appointment. Recognizing Gardner's enthusiasm as an amateur botanist, Herbert had first tried to have him appointed as his own assistant. When this proved unsuccessful he recommended him to the Conservator of Forests.) Gardner had already built up a sizeable private herbarium, under the guidance of Mrs Emily Pelloe, and his efforts had an immediate impact on the rate of acquisition by the Forests Department's herbarium. This was heightened by his participation in a major expedition to the Northern Kimberley in his first year, from April-October 1921, when he brought back some 400 sets of specimens, writing a major report of 105 pages (Gardner 1923), describing 20 new species, several varieties and recording an additional family for the state.

Gardner was soon found a position in the Department of Agriculture as assistant to the Economic Botanist and Plant Pathologist, W. M. Carne. He com-

menced duty in 1924. Inevitably, he rose two years later to become Assistant Botanist and Plant Pathologist. In January 1929 he became, at the age of 33, Government Botanist and Curator of the State Herbarium. This came about as a result of Carne's resignation in 1928 and the subsequent division of his post. (Nothing is known of Carne's own collections which seem to have left the state.)

Amalgamation

Before departing the scene, Carne took one last action which was to have major consequences. He (Carne 1926) addressed the Australian and New Zealand Association for the Advancement of Science (ANZAAS) meeting of 1926, urging the formation of a central State Herbarium, by amalgamating the independent collections held by Agriculture, Forests and the Museum, the first being the most complete, and the only one under the control of a botanist. As soon as the Premier's Department began to enquire into this proposal the Director of the Museum, Ludwig Glauert, advised his trustees to oppose any attempt to remove the Museum's collection, especially as it contained types, was of a considerable size (2,000–3,000 specimens) and was vested in a permanent body, the Trustees. On the other hand, he was willing for a combined herbarium to be housed in the Museum.

The Department of Agriculture argued its case on the basis of having a botanist of standing on staff, which the Museum did not, a circumstance necessary for dealing with 'the important herbaria of the World' (Sutton 1928). Furthermore, it was claimed that it had been found undesirable, throughout the world, to link herbaria with museums, and that they were more naturally linked with botanic gardens, this idea having been put forward by Carne. As the debate continued, extending even to letters in the press, the Museum's case was bolstered by its acquisition, in July 1928, of the substantial private herbarium (some 5,000 specimens) of local naturalist O. H. Sargent (1880–1952). Sargent was convinced the Museum was 'the proper place for a National Herbarium' and made it a condition of his gift that 'the specimens will remain ALWAYS at the Museum under the control of a corporate Board, and will always be available to serious students' (Sargent 1928).

The Museum's arguments were to no avail, however, and the Government made its decision, presumably later in 1928, in favour of the combined central herbarium being attached to the Department of Agriculture. Although the Forests Department was a willing partner in the coalition, it was not until 1957 that the Trustees of the Museum and Art Gallery resolved to make over their herbarium collection for amalgamation. According to A. S. George (pers. comm. 1985), the Museum collection comprised 3,500–4,000 mounted sheets, together with a large quantity of unmounted material, much of it Sargent's.

Gardner, sometime after the Forests Department's herbarium had been incorporated with the State Herbarium, gave the size of the collection, on 31 July 1946, as 29,121 specimens. This was a dramatic rise from the 'less than 8,000 sheets' of 'the two herbaria which were brought together' (Gardner 1947, p. 21). (The figure did not include the Museum collection, which was yet to be transferred, or the 1941 W. E. Blackall bequest.) In the same article Gardner noted the principal collectors represented in the State Herbarium. These were: himself (10,000 sheets), F. M. C. Schock (1,500), W. V. Fitzgerald (1,500), M. Koch, C. R. P. Andrews, N. T. Burbidge, B. T. Goadby and Blackall. Large numbers of duplicates had been received from Melbourne of Drummond, Maxwell and Mueller. As well, Gardner had procured, by exchange, many fragments of Diels and Pritzel, including types, from Berlin specimens when he went there during his term as Australian Botanical Liaison Officer (based in K) in 1937: the originals were soon after destroyed in the war, rendering the fragments at PERTH especially valuable today.

The Museum specimens were finally incorporated into the State Herbarium in 1959 or 1960 following that herbarium's move early in 1859 from the old Observatory Building to the Department of Agriculture's Head Office site at Jarrah Road, South Perth. Now renamed the Western Australian Herbarium, the combined state collection was finally moved in 1970 into its own, specially designed building, at the western end of the South Perth site where it is now set in a fine native plant garden. This year (1988), responsibility for its administration has been transferred from the Department of Agriculture to the Department of Conservation and Land Management.

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History of the Waite Arboretum and Waite Herbarium

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Abstract

Outlines of the origins and development of the Waite Arboretum and Waite Herbarium are presented. Portraits of past curators and others who have made substantial contributions are accompanied by short biographies. The Waite Arboretum, established in 1928 under the provisions of Peter Waite's bequest to the University of Adelaide, contains about 1,500 trees representing 770 species in 202 genera. Special effort has been made to obtain trees from homoclimes that might do well on the Adelaide Plains under natural rainfall. The Arboretum is an invaluable resource for seed collection, research, and teaching as well as providing a pleasant and informative recreational space. The Waite Herbarium comprised over 52,000 numbered sheets of primarily southern Australian species and weedy and agricultural species when it was transferred to the State Herbarium of South Australia.

On 3 October 1913, Peter Waite (Fig. 2) wrote to Sir Samuel Way, Chancellor of the University of Adelaide, stating his desire to offer as a gift to the University, his 'Urrbrae' estate, a mansion house set in 53 ha of agricultural and grazing land. The eastern half was to be used for the purposes of research and teaching in the fields of agriculture, botany, entomology, horticulture and forestry. The remaining 27 ha were 'to be a public park under the control of the University, but if it be thought advisable . . . 10 or 15 acres [4 or 6 ha], or such area as might be found necessary, should be used as a students' sports ground' (Edgeloe 1984, p. 7). Subject to the life tenancy of Mr Waite and of his wife, the Urrbrae estate was formally transferred to the University by deed of gift executed on 29 January 1914.

Occupation of the Urrbrae estate by the University took place on 3 February 1923, and on 26 March 1923 a committee of 12 members was appointed to make recommendations to the University Council on how best to give effect to the objectives of the bequest. The Committee's report, dated 19 May 1923, recommended unanimously that the public park take the form of an arboretum, to be designed and planted over a dozen years, and T. G. B. Osborn, Professor of Botany, offered to assist by finding seeds of rare or interesting trees (Urrbrae Committee 1923).

Planning and establishment of the Arboretum

The Arboretum location is 34°58′S, 138°38′E at an altitude 100–110 m. It is virtually frost free with a winter rainfall of 625 mm followed by a warm dry summer. Mr H. Hugh Corbin, Lecturer in Forestry, observed that 2,400,000 ha of land in South Australia has a climate like that of Urrbrae from an arboricultural point of view, so that the Arboretum would offer an exceptionally good opportunity for testing the adaptability of different species to local soil and climate, and thus its experimental value would be great (Corbin 1923). He prepared a tentative list of 56 trees to plant which included willows, elms, conifers, palms and figs. The Australian trees he suggested were silky oak (*Grevillea robusta* A. Cunn.), two species of native pine (*Callitris* Vent. spp.), four species of sheoak (*Casuarina* Adans. and *Allocasuarina* L. Johnson spp.), *Agathis* Salisb. and *Araucaria* Juss. species. Corbin recommended that the trees be spaced in such a way as to give ample room to show the natural growth habit of each species, and suggested a distance of 20 m between specimens.

Dr Arnold E. V. Richardson (Fig. 3), foundation Director of the Waite Institute (1924 to 1938), planned and established the Waite Arboretum with great energy and enthusiasm. In devising the layout and selecting the trees, Dr Richardson consulted with many authorities. In his report to the University Council (Richardson 1928b) he acknowledged the assistance and advice of the following specialists: Mr J. F. Bailey, Director of the Adelaide Botanic Gardens; Mr. F. J. Rae, Director of the Melbourne Botanic Gardens; Mr E. Julius, Conservator of Forests; Mr S. Griffiths, Government Town Planner; Mr G. Melville, Forest Department of South Australia; Mr G. Quinn, Chief Instructor of Horticulture; and Mr A. W. Pelzer, City Gardener. The original layout (Fig. 1) was primarily a series of circles and sweeping paths, with a broad stately avenue of English elms (*Ulmus procera* Salisb.) providing a magnificent vista from the centre of the Institute building to the sea.

Initially, two main areas were envisaged, with hardier indigenous trees on the higher areas where the soil is shallow and the subsoil of a gravelly nature, and exotic trees on the lower areas with deeper soil (Richardson 1928b). Arrangement of the trees within those two areas was to be on taxonomic grouping. Corbin (1923) considered that 'the scenic effect which may be produced by landscape forestry is not the object which is to be held in view but rather the economic and scientific value of the collection of trees and the data derivable from them'. In contrast, Richardson (1927) stated: 'Though the main aim of the Arboretum will be educational it is not desirable to sacrifice the aesthetic aspect of the planting for mere systematic and formal

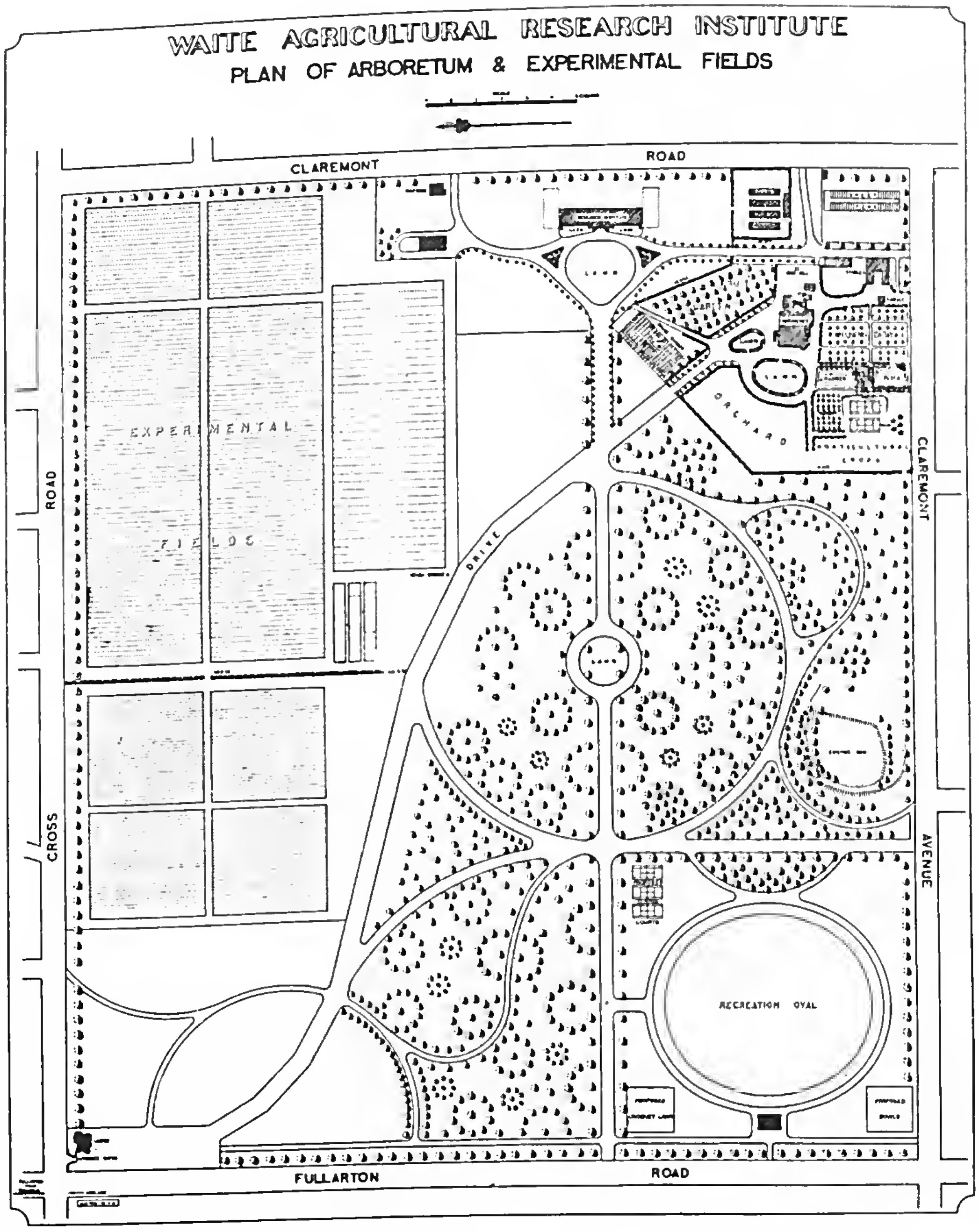

Fig. 1. Plan of Waite Arboretum (about 1931).

arrangement of species', and he envisaged a third area of mixed native and exotic species planted for aesthetic effect. However, this objective was never really achieved and has since lapsed.

Trees were obtained from a number of sources: 200 were donated by the Directors of the Botanic Gardens of Adelaide and Melbourne; the Federal Capital Commission gave 100; the New South Wales Forestry Commission supplied a fine collection of 460 trees and shrubs; and an additional 300 trees and shrubs were obtained from horticultural institutions and various nurseries in N.S.W., Victoria and South Australia (Richardson 1928b,c,d, 1929). In addition, seed came from New Zealand and the Boyce Thompson Arboretum in Arizona, and from Dr Richardson himself, secured on visits to California and Japan (Richardson 1927, 1928e).

Planting began in 1928, just three years after the Institute was established, and by 1930, some 1,020 trees representing 367 species in 180 genera and 67 families had been planted (Waite Institute Report 1925–1932). The expenditure for fencing, tree guards, labour, trees, water cart, and water supply for the first year was projected to be £350 (Richardson 1928b). Each tree was labelled with its botanical name, common name, family, area of occurrence and date of planting.

Frederick A. Couzens, Jnr (Fig. 4) grew up on the Urrbrae estate where his father was head gardener. In 1928, the first Director placed him in charge of the newly established Arboretum, at an annual salary of £203 17s (Richardson 1928a). During the next 40 years of his association, Couzens took particular interest in the eucalypts, and due in large part to him, the Waite Arboretum now has one of the most comprehensive collections of eucalypts anywhere, about 270 species and subspecies.

There are two special areas planted with eucalypts, one of over 70 large species established in 1949 in the northwest corner of the Arboretum, the other an enclosed area adjacent to Urrbrae House where 160 mallees were planted in 1955, small species in triangles, medium size in pairs, and the taller as single specimens.


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4



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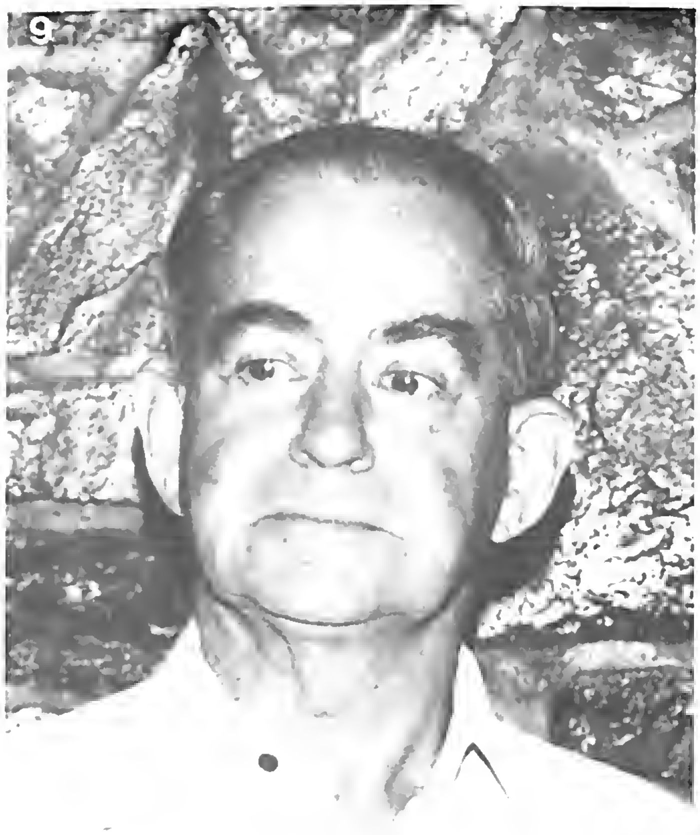
Figs 2–5. 2. P. Waite (Photograph: from *Our Pastoral Industry* 1910); **3.** A. E. V. Richardson; **4.** F. A. Couzens; **5.** J. A. Prescott. (Photographs 3–5: Waite Institute, Photographic Section.)

Figs 6 & 9. **6.** C. M. Eardley; **7.** E. L. Robertson (Photograph: David Robertson); **8.** D. E. Symon (Photograph: *The Advertiser*); **9.** R. D. Pearce. (Photographs 6 and 9: Waite Institute, Photographic Section.)

Couzens (1966) carefully recorded the success or otherwise of these eucalypts in his unpublished manuscript written on his retirement. Some of the larger eucalypts from higher rainfall areas of N.S.W. and Queensland flourished initially, but after more than 30 years, competition for water is high and a number of them have succumbed to summer droughts. However, every effort is being made to continue and enlarge this collection with the aim that ultimately, every eucalypt suitable to the area will be represented.

Emeritus Professor James A. Prescott (Fig. 5), second Director of the Waite Institute (1938 to 1955), was a soil scientist of international repute. Like his predecessor, Dr Richardson, he took a deep interest in the Arboretum and kept a firm hand on plantings. He was particularly keen on oaks, and together with Mr L. Pryor of Canberra, introduced 20 species of evergreen oaks from California. Professor Prescott was also a rose enthusiast, and added another 95 cultivars to Peter Waite's original rose garden.

The establishment of the Waite Herbarium and appointment of a taxonomic botanist

Constance M. Eardley (Fig. 6) was the first taxonomic botanist to join the staff of the Waite Institute. She held a joint appointment to the University of Adelaide Department of Botany and the Waite Institute as Curatrix of Herbaria from 1933 to 1949. The Adelaide Waite Herbarium (ADW) had been started in 1930 by Arthur B. Cashmore, when on a CSIR studentship (Symon 1984). At first the collection grew slowly, however, it increased substantially in the early 1940s with the donation to the Institute of the Albert Morris Herbarium of 8,000 specimens collected in the region of Broken Hill and western New South Wales.

Miss Eardley was a collaborator in the extensive ecological work of R. L. Crocker and N. S. Tiver and co-authored with Crocker a paper on a South Australian sphagnum bog (Crocker & Eardley 1939). Following an expedition to the Simpson Desert in 1939, in which Crocker took part, Miss Eardley published on its phytogeography compared with other sand-ridge deserts of the world (Eardley 1948). She also wrote several papers on weeds, and later was co-author with Veda Cruickshank of the pocket handbook *Wildflowers of the Adelaide Hills* (1972). In addition to the curation of the Herbarium, Miss Eardley was responsible for the management of the Arboretum. She initiated the recording of the height and diameter of certain trees some of which data were published in *Waite Institute Report 1933–1936*.

George H. F. Clarke, Botanist at the Waite Institute from 1936 to 1939, wrote a series of papers on weeds first published in the *Journal of Agriculture of South Australia*, and subsequently reprinted as a booklet (Clarke 1949). He contributed to the Waite Herbarium specimens of weeds associated with his research.

Nancy T. Burbidge was appointed Assistant Agronomist at the Waite Institute in 1943, mainly to undertake studies on germination and establishment of Australian Chenopodiaceae in the arid and semi-arid regions of South Australia. During this period she published work already completed in Western Australia on the morphology, and anatomy of *Triodia* R. Br., and devised a key to the South Australian species of *Eucalyptus* L. Hér. In 1946 she was appointed Systematic Botanist in CSIRO Division of Plant Industry in Canberra where she developed the then embryonic herbarium into a major centre for taxonomic research. Her position was subsequently transformed into that of Curator, Herbarium Australiense. Dr Burbidge's chief taxonomic studies were of *Enneapogon* Desv. ex P. Beauv. and *Triodia* (Poaceae), *Nicotiana* L. (Solanaceae) and *Helichrysum* Miller subg. *Ozothamnus* (R. Br.) N. Burb., *Ixodia* R. Br. and *Vittadinia* A. Rich. (Asteraceae) (Hartley 1977). Her contribution to the Waite Herbarium was small and consisted mainly of eucalypts and native grasses (Robertson 1986b).

Enid L. Robertson (Fig. 7) was appointed to the staff of the Waite Institute in 1947 as Systematic Botanist and was responsible for the taxonomic background to the paper by Dr K. Abele on the cytology of *Danthonia* Lam. & DC. (Poaceae). Mrs Robertson succeeded Miss Eardley in the curatorship of the Waite Herbarium and Waite Arboretum, and added to the herbarium many plants collected by her family when establishing their garden of Australian native plants at Wittunga in Blackwood (now part of the Botanic Gardens of Adelaide). Later, between 1953 and 1955, as a Senior Research Fellow in the University of Adelaide Botany Department, she undertook a revision of part four of J. M. Black's *Flora of South Australia* (Robertson 1965), and taxonomic research on Asteraceae. She has recently published on the seagrasses of southern Australia (Robertson 1984, 1986a).

Frank M. Hilton was Systematic Botanist at the Waite Institute from 1953 to 1955. During this time he commenced studies on the genus *Stipa* L. (Poaceae), and enriched the Herbarium with substantial collections of *Stipa* and other grasses. He collected particularly in the Upper Murray District (Renmark, Berri and Glossop), on Eyre Peninsula towards the Nullarbor Plain, and in the far north of South Australia near Mt Lyndhurst.

David E. Symon (Fig. 8) joined the staff of the Waite Institute in 1950, and was appointed Systematic Botanist in 1956 and Senior Lecturer in Botany in 1962. He has had a much greater influence on the Waite Arboretum than any of the previous botanists. In 1965, he instituted the policy of not watering trees after their establishment, and he made a special effort to obtain trees from areas with a climate comparable to that of South Australia such as South Africa, California, Chile and the Mediterranean region. He extended the collections of *Eucalyptus*, *Melaleuca* L. and *Casuarina* and established a number of arborescent monocotyledons and succulents.

Under Mr Symon's curatorship, the Waite Herbarium quadrupled in size. He contributed about 11,500 specimens with the accent being on accession of southern Australia species, and on weedy and agricultural plants. Mr Symon's taxonomic research included major revisions of *Cassia* L. (Fabaceae) and genera of the Solanaceae. His numerous publications include papers on *Oxalis* L. (Oxalidaceae), plants of the Simpson Desert, a bibliography of subterranean clover *Trifolium subterraneum* L., and many floristic lists for surveys done by the Nature Conservation Society of South Australia. A list of his publications and others from the taxonomic botany unit at the Waite Institute are given in Symon (1984). When he

retired as Reader in Agronomy in 1985, the position of Systematic Botanist was discontinued.

Laurie A. R. Haegi was on the staff of the Waite Herbarium as Professional Assistant from 1974 to 1977 working under a grant from Australian Biological Resources Survey. During that time he undertook taxonomic studies on *Datura* L. and *Lycium* L. (Solanaceae). His work on the Solanaceae culminated, in 1982, with the first taxonomic volume of the new *Flora of Australia* (volume 29), co-authored with David Symon and Rosemary Purdie. He is currently Horticultural Botanist at the Botanic Gardens of Adelaide, where his research interests focus on the genus *Hakea* Schrader (Proteaceae), Asteraceae, Solanaceae, and the systematics of cultivated plants. Dr Haegi was succeeded by Philippa Horton until the expiration of the grant at the end of 1979. During this period Dr Horton completed revisions of the genera *Nicandra* Adans. and *Nicotiana* L. in Australia.

Roy D. Pearce (Fig. 9) joined the Waite Institute in 1953 and in 1974 was appointed as Technical Assistant in the Herbarium. His duties included the fortnightly recording of flowering and fruiting data in the Arboretum, a practice initiated by Mr Symon. Mr Pearce performed this task diligently over the next 12 years, accumulating an extensive and valuable body of information, some of which was published in Boomsma (1981). Early in 1986, just before his retirement, Mr Pearce supervised the transfer, to the State Herbarium of South Australia (AD), of the very valuable Waite Herbarium, comprising over 52,000 numbered sheets plus numerous miscellaneous collections, reprints, seed collections and illustrations.

In May 1986, a new half-time position was created for a Botanist to manage and develop the Waite Arboretum and provide a taxonomic botany advisory service to the staff and students of the Waite Institute. Dr Jennifer Gardner was appointed.

The Waite Arboretum today

At present, the Arboretum contains about 1,500 trees representing 770 species in 202 genera. In addition to the extensive collection of *Eucalyptus*, and the very fine collection of evergreen Californian oaks, other special collections include *Pyrus* L., *Pistacia* L., *Juniperus* L. and *Melaleuca* L.

There is an index card for each specimen which, in addition to the information stated on each label, records the origin of the seed or seedling, growth measurements and flowering and fruiting data. When a tree dies or is removed, the card is transferred to a morgue file so that no data are lost. Scientific research presently being undertaken in the Arboretum by Dr Margaret Sedgley and her colleagues concerns the reproductive biology and hybridization of eucalypts.

Current plantings are limited primarily to replacement sites created by the death of trees or by the removal of some over-represented species. Rather rigid initial adherence to the circular patterns, together with a lack of appreciation of the eventual size of some species, had led to the crowding of some specimens so that their natural form is not so readily seen, and a number of sites have had to be abandoned. Wherever possible, new plantings conform to existing generic and family groupings.

International recognition

In October 1986, the International Dendrology Society (I.D.S.) awarded to the Waite Arboretum the Society's bronze plaque as an acknowledgement of the value of the Arboretum as an outstanding collection. The I.D.S. has over 1,000 members in 50 countries, and there has been only one other such award by the Society in Australia.

The Arboretum is open to the public, without charge, every day of the year during daylight hours. There is a steady trickle of local people as well as visitors from interstate and overseas. To foster an awareness of, respect for, and understanding of trees as part of the natural environment, school children and tertiary students are encouraged to visit the Arboretum and undertake assignments and projects. Horticultural students do practical exercises in tree maintenance and a number of University Departments (e.g. Botany, Entomology, Plant Physiology, Plant Pathology, Biochemistry and Agronomy) use the Arboretum as a resource for teaching or for experimental work. Many naturalist clubs and societies have excursions to the Arboretum, and photographs of trees in the Arboretum have been used to illustrate field guides and other books on trees. A marked trail is in place with an explanatory pamphlet available, and guided tours are conducted. The Arboretum is also promoted and widely publicised through the Waite Institute Open Days and at Garden Festivals and other public displays. There is no seed index, but seed is supplied on request, and a list is available of all species represented in the Arboretum.

The Waite Arboretum will continue to play an important role in the horticultural assessment of under-utilised or little known species, and efforts will be made to promote those trees which show potential for amenity and horticultural use. It is not only an invaluable resource for seed collection, teaching and research, it also provides a quiet, pleasant, informative recreational space and is a wonderful asset for all the people of Adelaide.

Acknowledgements

I am indebted to Mr David Symon for his generous assistance: his personal recollections of events before my arrival were most helpful. For their constructive comments on this manuscript I am grateful to Mr David Symon, Dr Margaret Sedgley of the Waite Institute, Dr Barbara Randell of the University of Adelaide and Dr Philip Short of the National Herbarium of Victoria. I thank Ms Susan Woodburn, Archivist, University of Adelaide; and for word-processing, Mrs Sue Suter and Mrs Elizabeth Wall.

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Botanical contributions overlooked: the role and recognition of collectors, horticulturists, explorers and others in the early documentation of the Australian flora

'In the very title page we see them robbed of the reward of their erudition . . .' (Ker-Gawler 1823)

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Abstract

Many of the earliest Australian plant names were published in illustrated magazines and horticultural lists in Britain and Europe. The authorship of these names can be obscure. Social attitudes of the day influenced who was able to publish and whether or not their work was acceptable. As a result the contributions of such people as the gardeners John Kennedy and James Lee, the Linnaean scientists Daniel Solander and Jonas Dryander, and the scientific outcast Richard Salisbury are not well known. A number of manuscripts placed in the care of Joseph Banks by Solander and other early collectors such as James Anderson, George Bass and William Paterson were never published by Banks. Their authors as a result lost credit for their observations. Robert Brown's *Prodromus*, the first attempt at a flora of Australia, is partly a synthesis of the work of many of these unacknowledged people.

With the growth of settlements in Australia in the early to mid 1800s, many of the educated resident collectors provided more than just collections of plants to botanists, particularly to those in Britain. In their correspondence they often provided short descriptions of the plants, commented on their novelty, and sometimes named them. In the present day it is likely that the principal recipients of their collections, Robert Brown, John Lindley and William Hooker, would have published the many new plants they described and named under joint authorship. The failure of resident collectors such as Allan Cunningham, Charles Fraser, Ronald Gunn, James Backhouse, James Drummond and Ludwig Leichhardt to publish many or any of their observations themselves led to their losing credit for much of their original work. Thomas Mitchell was one who took steps to gain maximum credit for his contributions by personally supervising the publication of the journals of his four expeditions and their botany. Reliance on 'mother' Britain, both politically and scientifically, still existed and attempts to form scientific societies in Australia were in their infancy. It was not until the coming of Ferdinand Mueller that scientific publishing took place within Australia. Mueller's effect on documentation of the Australian flora within Australia is briefly touched upon.

The identity of many early collectors of Australian plants has also been obscured, partly no doubt through the social attitudes of the time. The published journals of a selection of the early expeditions, both maritime and into the interior of Australia, indicate that collections were often the result of more than just the principal botanist, such as Robert Brown on Flinders's voyage, or the expedition leader, such as Thomas Mitchell or Charles Sturt.

The implications for taxonomy of these overlooked contributors is discussed with respect to the citation of authorship of early names and their typification. Differences in pagination of the two editions of Thomas Mitchell's *Three expeditions into the interior of eastern Australia* are detailed in an appendix.

Contents

Introduction

Taxonomists frequently come into contact with history. Documentation of the changing distribution of native species and aliens, and the derivation of names, all require recourse to old literature. The most frequent use of history in taxonomy, however, is in the achievement of correct and therefore stable nomenclature through the determination of the principal type specimen of names. This procedure, called typification, requires interpretation of the original documents in which a species was described.

In this paper we review a selection of the published literature to discover the extent to which the current view of the participants in the documentation of the Australian flora is a just one. We have concentrated on British involvement, not only because of our difficulty with non-English languages and poor representation of foreign history books in our libraries, but also because this is so central to the history of Australian plant systematics.

Many Australian species were originally described in Europe by well-known names of botany, such as Robert Brown, the Hookers, father and son, and George Bentham. Not until Ferdinand Mueller's time were descriptions published in Australia. All of these people relied heavily on the acquisition of specimens from collectors. Only rarely, as in the case of Jacques Labillardière, Robert Brown and Ferdinand Mueller, were significant personal collections made by the botanist himself.

The first major botanical collection from Australian shores was that of natural scientists Joseph Banks and Daniel Solander in 1770 on Cook's voyage. Their failure to publish the results of this gathering has made them, by default, collectors only. Similarly, 30 years later the botanist on Flinders's voyage, Robert Brown, produced a detailed manuscript on the Australian flora known to that time. Only part of this work was ever published, in the form of a concise *Prodromus* (Brown 1810b). For that part of the flora which was not covered within this publication he too is now in effect merely a collector.

The early collectors of Australian plants rarely concentrated on botany alone. As a result of the great demand for natural history specimens in general, there is much overlap in the early history of zoological, geological and botanical collecting in Australia (Finney 1984).

These early collectors came from all walks of life and had diverse backgrounds. They ranged from the gentry to anonymous convicts and Aborigines, from those trained in medicine and natural history to those lacking any formal education. Some came to New Holland specifically for the purpose of collecting plants. Among these were Ludwig Preiss, George Caley and Robert Brown, while some, such as Allan Cunningham, Ludwig Leichhardt and George Bass, combined the functions of collecting and exploration. Others such as Charles Sturt, Thomas Mitchell and Ernest Giles were primarily explorers but brought back natural history oddities. Still others were the often anonymous subordinate members of collecting parties and exploring expeditions.

How were the contributions of these people acknowledged by the scientists and nurserymen who

used their collections? Has science recognized them subsequently? Our research, predominantly into the British collectors of higher plants, has shown that the acknowledgement was as varied then as it is today. Recognition has not always been given to those who most deserved it.

Following a brief background introduction, discussion centres on three main themes. The first is given to consideration of the naming of plants in Britain and Europe following the arrival of the first botanical specimens from Australia. By looking at some specific examples it will be illustrated that a number of botanists of the time were not adequately recognized for their work. The second theme deals with the activities of a number of collectors within Australia and assesses their input into botanical names subsequently published, for the most part in Britain. The shift of authorship to Australian botanists, begun principally by Mueller, is briefly considered. The third theme is a comparison of the role played by more or less anonymous gatherers with that of their more publicised associates in the early searches for Australian plants. Finally, the implications of findings of this review upon nomenclatural aspects of systematic work are considered.

I. Background

The founding of Australia coincided with a great interest in Europe in natural history. The expanding empires of Britain and France in particular had led to the introduction into Europe of many novelties, both zoological and botanical. The introduction by Linnaeus of the binomial system of nomenclature together with his sexual system of classification meant that there was now a practical method of documenting and comparing the plants of the world.

Initially in England the principal proponents of the new methodology were two Swedish students of Linnaeus, Daniel Solander and Jonas Dryander, both in turn employed by Joseph Banks. Their careful cataloguing of the multitude of botanical novelties which were sent to Banks provided the foundation for many botanical publications, including those on the Australian flora.

Interest in botanical oddities was also promoted in other ways. Kew Gardens was established under the auspices of Royalty and at about the time of Joseph Banks commencing as its horticultural adviser in 1772 it became the principal European repository for plants from overseas (Blunt 1978). Many of the nobility shared this interest with their king and they also sought unusual plants for their gardens. In response to this demand a number of nurseries were either established at this time or expanded. Plant collectors were dispatched by the nurseries and botanical gardens to poorly known parts of the world, and there was a significant exchange of material, both living and dried, among European botanic gardens, nurseries, individual botanists and gardeners (Nelson, this volume).

Voyages of discovery that were commonly undertaken at the time invariably had a number of naturalists on the staff, among them usually a botanist and a gardener. Among British expeditions, James Cook on his first two voyages had three naturalists with two on his last, while Matthew Flinders had one naturalist and one gardener. On the French expedition of 1791–1794 in search of la Perouse, d'Entrecasteaux had five naturalists and one gardener. Nicholas Baudin, who had previously led botanical voyages to the Orient and the South Seas, set out in 1800 for New Holland with 24 scientists; of these three were botanists and five gardeners. Most of them died or deserted before the major work on the Australian coastline took place (Marchant 1982; Brosse 1983).

Artists also became a necessary component of these voyages. Before his first voyage with Cook to Tahiti, Joseph Banks had already employed the renowned botanical illustrator Georg Dionysius Ehret to depict some of the plants he had collected in Newfoundland. For this new expedition he was encouraged by his friends in the Society of Arts to employ an artist to depict the landscapes and another to record the plants and animals (Smith 1984). Such a suggestion had been made some years previously in both English and French accounts of voyages, but Banks was the first to put this idea into practice. Banks employed Alexander Buchan for the landscapes and Sydney Parkinson for the natural history specimens. While both of these artists were to die on this voyage, Parkinson's prodigious output of about 740 illustrations ensured that later voyages had the services of at least one artist.

One further fact promoted interest in natural history. No longer was the subject being presented purely in Latin but works were beginning to appear in the language of the author. Thus, at about the time of the founding of the colony at Port Jackson, interest in botanical novelties was combined with artistic representations of such plants, often with an account of the plant in the language of the country and above all a 'simplified' name in the form of a binomial.

II. Documentation of botanical novelties in Europe

The means of documentation of the incoming plants varied. Descriptions of new species appeared in the results of the voyages of discovery, for example William Dampier's account of the natural history of northwest Australia from his 1699 voyage (Williamson 1939) and Labillardière's (1805) *Novae Hollandiae plantarum specimen* from d'Entrecasteaux's voyage. They also appeared in annotated lists and catalogues of the holdings of nurseries and public and private gardens. A further important vehicle of publication were illustrated magazines specializing in new introductions.

Often the title pages of these illustrated magazines did not tell the full story. The author whose name appeared there rarely produced the work unaided. The forms of assistance varied, as did the acknowledgement. Help was often given in the provision of collections either from Australia through seed collectors, explorers or naturalists, or from nurserymen in Europe who cultivated material sent from Australia to satisfy public demand. Unpublished manuscripts provided another source of information which was often not acknowledged.

The authorship of botanical names is another way in which the contribution of botanists to their science can be gauged. However, the present rules for citing

authorship of botanical names are ambiguous and, as will be shown, can present a distorted view of the contributions of some botanists. Real contributions by people not involved in the mechanics of publication have often been overlooked.

A. Manuscripts and publications arising from Cook's three voyages

Solander's manuscripts

> *Solander's name will appear next to mine on the title page because everything has been brought together through our common industry. There is hardly a single clause written in it, while he lived, in which he did not have a part . . .* (Banks to Clas Alströmer[1])

A number of manuscripts resulted from Banks's 1768–1771 voyage with Cook. The most important of these were by the Linnaean student Daniel Solander. Plant descriptions by Solander were much more detailed (Britten 1900–1905; Stearn 1984) and modern in form than those usually presented in the publications of the period. A catalogue of those Solander manuscripts held in British institutions has been published by Diment & Wheeler (1984). Solander's published plant names have been listed by Krok (1925). However, unpublished binomials coined by Solander have been adopted by a number of botanists who had access to the Banks Herbarium, which included Solander's manuscripts. A number appeared in the posthumous publication of Sydney Parkinson's (1773) *Journal of a voyage to the South Seas* over which there was so much acrimony between Banks and Stanfield Parkinson, the brother of Sydney Parkinson (see preface to that work; Merrill 1954; Beaglehole 1962; Willson 1961; Carr 1983). The majority of Solander's binomials appearing in this work are considered unpublished under nomenclatural rules as the descriptions are inadequate to recognize the plants. In those few cases where the descriptions are adequate, e.g. *Spondias dulcis*, *Pandanus tectorius*, *Sitodium altile* (now known as *Artocarpus altilis*) and *Anistum fagiferum* (now *Inocarpus fagifer*), there are other controversies about the author citation (St John 1972; Stone 1988). In none of them is Solander acknowledged in the author citation.

Another group of publications which were to involve Joseph Banks in controversy were those of the Forsters, father and son, who replaced Banks and Solander at the last moment as botanists on Cook's 1772–1775 second voyage. In 1776, the Forsters jointly produced *Characteres generum plantarum*, while the son, George Forster, published his *Prodromus* in 1786. They had access to Solander's manuscripts, Parkinson's drawings and the Banks herbarium on their return from the voyage and relied heavily on these, with little acknowledgement, for their publications. The pirating of Solander's names, at least with respect to Tahitian plants, is described by Merrill (1954) in his discussion of the botany of Cook's voyages. Allan (1961) rectified this in relation to New Zealand plants in the first volume of the latest edition of the *Flora of New Zealand*, judging by the many author citations in the form 'Solander ex . . .'. The volume was dedicated 'to the memory of Daniel Carl Solander F.R.S.'

Other people to have access to the Banks Herbarium and Solander's manuscripts were European botanists such as Joseph Gaertner, the younger Linnaeus, Vahl, Willdenow, Lamarck and A. P. de Candolle, all of whom published names included in Solander's manuscript *Plantae Novae Hollandiae* or written on his specimens. While some were careful in crediting names to Solander, others were not (Table I).

The celebrated botanist Robert Brown used Solander's manuscripts extensively. Before his departure for Australia as botanist on Flinders's voyage, not only did he copy Solander's descriptions of Australian plants, he also formed an herbarium 'from the specimens brought by different collectors from Botany Bay — but chiefly from Sir Joseph's own collections' (Brown's diary, quoted in Mabberley 1985). While Brown published some names with acknowledgement to Solander, it is clear that there were a number published where he chose to take up Solander's epithet without any credit to him (Table I). In his treatment of the Proteaceae, discussed later, Brown (1810a) published Solander's description of *Knightia excelsa* of New Zealand. It was by far the longest in the work and was clearly attributed to Solander:

> For the figure here given I am also indebted to the liberality of the illustrious President of the Royal Society, who has enabled me to complete the account of this remarkable plant, by permitting me to copy Dr Solander's description, which I was the more desirous to give, as it exhibits a specimen of the accuracy with which subjects of natural history were investigated in that celebrated voyage; of whose important results it is to be lamented so little is known to foreign naturalists, though in this country they have ever been open to the public, and in the most advantageous manner.

Despite this, authorship has been attributed to Brown alone in subsequent literature, even by Solander's champion H. H. Allan (1961).

The principal author of *Flora australiensis*, George Bentham (1863–1878) was also guilty of using Solander's epithets without any tribute to the original author. However, with almost a century elapsed, the original authorship may have been obscure. According to his introduction to the *Flora*, Bentham consulted only a few of the specimens collected by Banks and Solander, and (Britten 1907) none of the associated plates, mainly confining himself in his visits to the British Museum to studying Brown's manuscript and herbarium, in which Banks and Solander's names occasionally appear.

The author citations of some of Solander's names in current literature (Table I) contain varying acknowledgement of Solander's contribution. Citations range from 'Solander' to 'Banks & Solander' to 'Banks' or, in many cases, to no reference at all to Solander or his sponsor. Individual species may be cited differently from text to text. Thus, *Philydrum lanuginosum* is referred to 'Gaertn.' in Diment *et al.* (1984), but 'Banks & Sol. ex Gaertn.' in Adams (1987).

Whether any credit should be given to Banks for the coining of these names is not clear. While he financed the scientific part of the voyage and participated in the collecting it is unlikely that he had the major role in the documentation of the flora. Solander was employed for this purpose and (Diment & Wheeler 1984) the manuscripts are his. Thus, any authorship mentioning

Table I
The current treatment of some names formulated by Solander in which the epithet used today remains unchanged, extracted from Diment *et al.* (1984)

*Name in Solander's manuscript	Currently accepted name and author citation used
Attributed to Solander	
Philadelphus squarrosus	*Leptospermum squarrosum* Sol. ex Gaertn.
Metrosideros viminalis	*Callistemon viminalis* (Sol. ex Gaertn.) G. Don
Metrosideros viridifolia	*Melaleuca viridifolia* Sol. ex Gaertn.
Metrosideros nodosa	*Melaleuca nodosa* (Sol. ex Gaertn.) Smith
Melaleuca suaveolens	*Tristania suaveolens* (Sol. ex Gaertn.) Smith
Pomax umbellata	*Pomax umbellata* (Gaertn.) Sol. ex A. Richard
Attributed to Banks and Solander	
Dillenia alata	*Dillenia alata* (R. Br. ex DC.) Banks & Sol. ex Martelli
Capparis lucida	*Capparis lucida* (Banks & Sol. ex DC.) Benth.
Polygala rhinanthoides	*Polygala rhinanthoides* Banks & Sol. ex Benth.
Octanthera secunda	*Comesperma secundum* Banks & Sol. ex DC.
Gauroides alulata	*Boronia alulata* Banks & Sol. ex Benth.
Utricularia albiflora	*Utricularia albiflora* Banks & Sol. ex R. Br.
Utricularia limosa	*Utricularia limosa* Banks & Sol. ex R. Br.
Attributed to Banks	
Capparis canescens	*Capparis canescens* Banks ex DC.
Attributed to neither Banks nor Solander	
Adelioides decumbens	*Hypserpa decumbens* (Benth.) Diels
Viola monopetala	*Hybanthus monopetalus* (Roemer & Schultes) Domin
Jambolifera alba	*Correa alba* Andrews
Crotalarioides fruticosa	*Lamprolobium fruticosum* Benth.
Glycine retusa	*Vandasia retusa* (Benth.) Domin
Glycine rubicunda	*Kennedia rubicunda* (Schneevoogt) Vent.
Dolichas giganteus	*Mucuna gigantea* (Willd.) DC.
Mimosa suaveolens	*Acacia suaveolens* (Smith) Willd.
Mimosa grandiflora	*Abarema grandiflora* (Benth.) Kostermans
Rhizophora gymnorrhiza	*Bruguiera gymnorrhiza* Lam.
Metrosideros citrinus	*Callistemon citrinus* (Curtis) Skeels
Melaleuca angustifolia	*Melaleuca angustifolia* Gaertn.
Lobelinum alsinoides	*Stylidium alsinoides* R. Br.[1]
Lobeliastrum pedunculatum	*Stylidium pedunculatum* R. Br.[1]
Lobelia filiformis	*Lechenaultia filiformis* R. Br.[2]
Lobelia rotundifolia	*Goodenia rotundifolia* R. Br.[2]
Laugerioides ruscifolia	*Leucopogon ruscifolia* R. Br.[1]
Asclepiadea nummularia	*Dischidia nummularia* R. Br.[1]
Exaeoides pygmaea	*Dischidia pygmaea* R. Br.
Exaeoides stellata	*Mitrasacme stellata* R. Br.[1]
Exacoides laricifolia	*Mitrasacme laricifolia* R. Br.[1]
Erinus tetragonus	*Buchnera tetragona* R. Br.[1]
Duplanthera tetraphylla	*Deplanchea tetraphylla* (R. Br.) F. Muell.
Ruellia angustifolia	*Hygrophila angustifolia* R. Br.[1]
Dianthera juncea	*Justicia juncea* R. Br.[2]
Callicarpa pedunculata	*Callicarpa pedunculata* R. Br.[2]
Ocymum foetidum	*Plectranthus foetidum* Benth.
Cunila fruticosa	*Westringia fruticosa* (Willd.) Druce
Pharnacioides arborescens	*Deeringia arborescens* (R. Br.) Druce[1]
Laurus glauca	*Endiandra glauca* R. Br.[1]
Leucadendroides glauca	*Grevillea glauca* J. Knight
Leucadendrum ericaefolium	*Banksia ericifolia* L.f.
Leucadendrum integrifolium	*Banksia integrifolia* L.f.
Leucadendrum dentatum	*Banksia dentata* L.f.
Taxoides latifolia	*Exocarpos latifolius* R. Br.[2]
Urtica argentea	*Pipturus argenteus* (G. Forster) Weddel
Epidendrum canaliculatum	*Dendrobium canaliculatum* R. Br.[1]
Epidendrum rigidum	*Dendrobium rigidum* R. Br.[1]
Anthericum caeruleum	*Dianella caerulea* Sims
Philydrum lanuginosum	*Philydrum lanuginosum* Gaertn.
Xyris paludosa	*Xyris paludosa* R. Br.[1]
Pomax umbellata	*Pomax umbellata* (Gaertn.) Sol. ex A. Richard

* Names of those genera ending in '*oides*' were used by Solander merely to indicate relationships with the genus forming the stem of the name (Stearn 1966).
1 Banks and Solander's specimen(s) cited by Brown (1810b) in his *Prodromus*.
2 Banks and Solander's specimens not cited by Brown in his *Prodromus*.

only Banks is likely to be erroneous. Furthermore, the citation of Banks as the first author when the two are attributed joint authorship, dating as it does from the time of Banks's great influence on British botany, may reflect his social status rather than any true claim to it. Indeed, 20 years after his death Banks was described in the *Florists journal* of 1840 (Desmond 1982) as a man 'having no pretensions to profound knowledge himself, but excellent tact in finding out and great liberality in rewarding those who had'. It is surely a debatable point as to whether his two Swedish recruits would today consider that they had been so liberally rewarded.

Despite this, it would be unwise to deny Banks any contribution to the results of Cook's voyage. Britten (1905) has given a contrasting view of Banks as a botanist in his introduction to three volumes of plates with descriptions of Australian plants collected by Banks and Solander (Britten 1900–1905):

> It will be observed that the names of species which have been adopted by various authors from Solander's MSS. are throughout the present work attributed to Banks and Solander, although in many instances Solander alone was originally quoted for them. A careful study of the various memoranda and MSS. preserved in the Department of Botany [British Museum] makes it clear that Banks, who had come to be regarded as a patron of science rather than as a man of scientific attainments, had much more botanical knowledge than was at one time supposed. This seems to have been recognized by his contemporaries; thus Smith [*Rees cyclopaedia* (1819), under *Jasminum*] speaks of what are generally called the Solander MSS. as the work of Banks and Solander, and Patrick Russell [in preface (1794), p. viii] says that the catalogue of plants in the second edition of the Natural History of Aleppo was drawn up by Banks and Solander, although it has been customary to attribute the new species to Solander only.

Solander worked in the period when scientific publication was in its infancy, just before the newly formed scientific societies produced journals. He would have required special financial support to publish his work separately from Banks. In any case, having been sponsored by Banks, he would almost certainly have been obliged to publish his work jointly with him. Claims that laziness and dissipation were the reasons for Solander's failure to publish are hardly to be countenanced, for he produced numerous manuscripts and had prepared for publication all his descriptions but for those of Australian plants (Britten 1905; Marshall 1984).

Further manuscripts from Cook's voyages
On Cook's third voyage (1776–1780) William Anderson the surgeon and David Nelson the midshipman and gardener collected plants. Anderson had been the assistant surgeon on Cook's previous voyage of 1772–1775 and assisted the Forsters in their collecting (Brosse 1983). Both he and Nelson were commemorated in generic names by Robert Brown. In dedicating *Nelsonia* (Acanthaceae) in honour of David Nelson, Brown (1810b) paid tribute to the large number of new species found by Nelson on this voyage.

Manuscripts by William Anderson are mentioned by Brown (l.c.) in his partial dedication[2] to him of the genus *Andersonia* (Epacridaceae). These manuscripts, found by Brown amongst the Banks Papers ('*tom.* 2, p. 32; *et tom.* 3, p. 184'), must have been produced before 1778, the year in which Anderson died during Cook's third voyage (Brosse 1983). From them Brown cited four Australian genera which had been recognized by Anderson: *Collema* by then published as *Goodenia* Smith in 1794, *Euphocarpus* published as *Correa* Andrews in 1798, *Ramsaia* published as *Bauera* Banks ex Andrews in 1801, and *Aromadendrum* published as *Eucalyptus* L'Herit. in 1789.

One of Anderson's other generic names, *Pringlea*, was taken up much later by J. D. Hooker (1844–1847) in his *Flora antarctica* when he named the antiscorbutic 'Kerguelen-Land Cabbage'. Hooker credited Anderson with its authorship.

B. Early publications involving Australian plants and their authorship

Illustrated magazines
A number of Australian plants first appeared in illustrated botanical magazines. These began in 1787 with the journal popularly known as *Curtis's botanical magazine* after its first editor William Curtis. It employed artists, chief of whom initially was Sydenham Edwards. The success of *The botanical magazine* prompted a number of rival publications. Unlike their predecessor, these often took the name of the artist rather than the author of the descriptions.

Actual authorship of the descriptions of new plants which occur in these magazines can be obscure. John Lindley and John Ker-Gawler (also known as John Bellenden Ker and other variations) were responsible for the descriptions in Sydenham Edwards's *The botanical register* (1815–1847). Nowadays authorship of names in the early volumes is invariably assigned to one or other of them. However, in the first 14 volumes, edited by Ker-Gawler (Stafleu & Cowan 1976–1988), Ker-Gawler's name does not appear anywhere. Fortunately Lindley concluded his contributions with 'J.L.', even before his name first appeared on the title page in volume 15 of the series. Authorship in the artist William Hooker's *The paradisus londinensis* (1805–1808) was often attributed to Hooker in contemporary works, despite Richard Salisbury being responsible for the descriptions. Salisbury's name did not appear on the initial title page. It did appear on the reprint in 1806 and all subsequent issues (Stafleu & Cowan 1976–1988). Today authorship of names is correctly attributed to Salisbury.

The treatment of authorship in Henry Andrews's *The botanist's repository* (1797–1815) is quite different, as discussed by Britten (1916b). The title page states that the whole had been executed by Andrews (Fig. 1). Despite this statement, Andrews (1805) himself admitted in the preface to a later work on geraniums, in which he also claimed sole authorship, that 'in the descriptions of the first five volumes of his *Botanists' repository* he was assisted by gardeners and cultivators; and in the sixth and last volume by a botanist whose opinions were diametrically opposite to those of the former'. Thus Andrews admitted what was already known amongst the botanical community, that John Kennedy, Andrews's father-in-law and co-proprietor of the famed Lee & Kennedy nursery (see later), was responsible for the descriptions in the first five volumes. Those of the sixth volume were produced by Haworth, who was possibly also involved with George Jackson in the seventh. The later volumes were edited by George Jackson. Unlike the other magazines mentioned, authorship continues to be attributed to this day to Andrews, such as in *Correa alba* Andrews, *Parahebe derwentiana* (Andrews) Briggs & Ehrendorfer.

Hortus kewensis, ***a garden list***
It is already well documented that *Hortus kewensis*, a catalogue of the Kew collection published by William Aiton in 1789, was not his work alone (e.g. Britten 1912; Stafleu & Cowan 1976). Both Solander and Dryander contributed considerably to this work, and many of their new species were published in it. Yet nowhere within the publication is there any acknowledgement of Solander or Dryander. This injustice was compounded when William Aiton's son, W. T. Aiton, produced a second edition in 1810 to 1813, this time with the help of Dryander and Robert Brown. Again acknowledgement is lacking from these volumes until the final postscript of volume 5 in 1813 when W. T. Aiton partially redressed the omission in paying tribute to his deceased friend Jonas Dryander who:

> exerted his best talents not only in improving the plan, but in arranging the material of the Catalogue for the press, and correcting the proof sheets during the progress to the printing.

To Robert Brown he:

> attributed the improved state of the latter volumes of this work. Much new matter has been added by this gentleman, and some without reference to his name; but the greater part of his able improvements are distinguished by the signature of Brown mss.

Why Brown should have been afforded recognition in author citations while Solander and Dryander were not is unexplained. The two Swedish botanists contributed many of the names (Krok 1925). Further examples of lack of acknowledgement of their recognition and naming of taxa are given later.

At a somewhat later date, John Ker-Gawler (1823) was extremely scathing of the Aitons when he referred to *Hortus kewensis* as a 'monument of the taste and criticism of Solander and Dryander, the worthy disciples of Linnaeus, and the most accomplished scholars of their age', even though:

> in the very title page we see them robbed of the reward of their erudition (and we know they received no other) to give immortality and renown to vulgar ignorance, the

Fig. 1. The engraved title-page of the first volume of Andrews's *Botanists repository*, in which all credit is taken by the artist.

names of native dunces being suffered to usurp the place belonging to those of the genius and talent of another land.

For a more complete history of *Hortus kewensis* and a consideration of authorship of the plant names see Britten (1912).

Richard Salisbury's Prodromus *and* Paradisus londinensis

One of the garden lists of the day was Richard Salisbury's (1796) *Prodromus stirpium in horto ad Chapel Allerton vigentium.* It comprised brief descriptive accounts of the plants he had in cultivation at Chapel Allerton. Many of the names published in it had priority over later names for the same plant but were ignored by the scientists of the day. This was rectified over a century later by Britten (1916a). It is likely that Salisbury was not the sole formulator of names in this work as has previously been thought, although the extent to which others were involved is not clear.

There is some evidence that James Lee, joint founder of the Lee & Kennedy nursery, one of the eminent nurseries of the day, provided some names to Salisbury. Under Proteaceae (p. 48) the form of the entry in a number of cases is:

> PROTEA
> Anemonefolia 1. P. foliis 2-pinnatifidus: laciniis 2–3-jugis, linearibus, scabriusculis, pubescentulis, supra canaliculatis.
> Ex Port Jackson auct. Jac. Lee.

'Jac. Lee' refers to James Lee. Lee was a friend of Banks. He was a frequent visitor to the Banks Herbarium, where he would undoubtedly have had contact with Solander and then Dryander. He recommended the artist Sydney Parkinson, a fellow Quaker and Scotsman, to Banks and also David Nelson, the gardener on Cook's third voyage. The Lee & Kennedy nursery was the recipient of many of the first seeds sent from Australia, and for some time it specialized in supplying New Holland plants (Willson 1961). Furthermore, Lee was acquainted with the binomial and the Linnaean system. He corresponded with Linnaeus and was responsible for the first English translations of Linnaean ideas. The title of this work (Lee 1760) was:

> An introduction to botany containing an explanation of the theory of that science and an interpretation of its technical terms extracted from the works of Dr Linnaeus and calculated to assist such as may be desirous of studying that author's method and improvements.

There were ten editions, the last appearing in 1810, well after Lee's death in 1795.

What does Salisbury mean by 'auct. Jac. Lee'? The meaning of the Latin *auctor* presents a number of possibilities; it could be that authorship is being attributed to Lee by Salisbury, or it could be that the seeds or plants were given to Salisbury by Lee, or possibly just the information that they came from Port Jackson is being attributed to Lee.

Reference to his later work *The paradisus londinensis* (Salisbury 1805–1808), in which Salisbury commonly uses the apparently synonymous English phrase 'communicated by Messrs Lee and Kennedy', shows that Salisbury did use names supplied by Lee and Kennedy without acknowledgement. In its volumes Salisbury published much of his original work and his arguments for natural classification. Under species number 24, *Protea mucronifolia*, we find the following statement:

> This new Proteaceae was communicated by Mess. Lee and Kennedy; in a natural series, which is the grand object that all true Botanists keep in sight, whether species or genera are to be determined, it must be placed near *P. acuifolia.* ... The author of the Exotic Botany [J. E. Smith] having sent an oblique shot against the ***very appropriate name given to that species by the distinguished collectors*** above mentioned I might leave them to defend it: ... but as in my opinion he attempts to mislead the taste of the public I shall very willingly say a few words to vindicate ***their appellation.*** [Our highlighting]

Protea acuifolia had been published earlier as species number 2 in the same *Paradisus londinensis* series; its name has always been attributed to Salisbury. Under it there was no mention of Lee and Kennedy supplying the name:

> it was communicated by Messrs Lee and Kennedy, whose liberality in giving specimens of their rarest plants to Botanists does them credit.

A second example of Lee and Kennedy supplying the name is to be found under species number 11, *Protea glaucophylla*, in the same work where the text reads as follows:

> Though so different in the leaves, this shrub ... was likewise communicated by Messrs Lee and Kennedy. As it always has a stem, though a very short one, ***I very willingly adopt their name*** [Our highlighting].

The plant had previously been known as *Protea acaulis.*

Thus Lee and Kennedy did provide names. By 'communicated' and the earlier 'auct.' Salisbury apparently meant in some, if not all, instances not just giving specimens, but the provision also of information which, at least in the cited cases, included the provenance and the name. As nurserymen, Lee and Kennedy would presumably have had to provide names when distributing their New Holland plants. Reference has already been made to Kennedy's contribution of names to Andrews's *The botanist's repository.* Whether Lee provided names in the case of Salisbury's (1796) *Prodromus* we shall probably never be certain. The names involved are simple (Table II). They invariably refer to the leaves and could well have been coined by a nurseryman where only vegetative material was available. It remains to be investigated how often the phrase 'communicated by Messrs Lee and Kennedy' in *The paradisus londinensis* indicates that the nurserymen provided the plant name.

Joseph Knight's controversial work on the Proteaceae

Richard Salisbury was further involved in controversy in the publication of a work on Proteaceae which has for almost two centuries been claimed to be a plagiarism of the work of Robert Brown. Robert Brown noted in his diary on 9 November 1808 (Mabberley 1985) that Dryander had begun the new edition of *Hortus kewensis* and that he wished Brown to publish on Proteaceae so that he might use the new genera. In response to this request Brown prepared and read to the

Table II

Names in Australian Proteaceae published in R.A. Salisbury's (1796) *Prodromus Chapel Allerton* which are possibly attributable to James Lee

Name in Salisbury (1796)	Current name and author citation
Protea anemonefolia	*Isopogon anemonefolius* (Salisb.) Knight
Protea anethifolia	*Isopogon anethifolia* (Salisb.) Knight
Protea fucifolia	*Petrophile fucifolia* (Salisb.) Knight
Banksia tenuifolia	*Hakea sericea* Schrad. & J. Wendl. (*non Hakea tenuifolia* Dum. Cours.)
Banksia pinifolia	Illegitimate as *Banksia gibbosa* Smith cited as synonym
Banksia teretifolia	*Hakea teretifolia* (Salisb.) Britten
Banksia oleaefolia	*Hakea dactyloides* (Gaertner) Cav. (non *Hakea oleifolia* (Smith) R. Br.)
Banksia serratifolia	Illegitimate as *Banksia serrata* L.f. cited as synonym
Banksia asplenifolia	*Nomen dubium* (George 1981a); neotypification would have preserved this name, in use in New South Wales before 1981 for what is now known by the later name *Banksia oblongifolia* Cav.
Banksia phylicaefolia	Illegitimate as *Banksia ericifolia* L.f. cited as synonym

Linnean Society his paper 'On the natural order of plants called Proteaceae' on four separate dates between 17 January 1809 and the 7 March 1809. This work was not published until 8 March 1810.

In the time between Brown's lectures and the publication there appeared a work written by Joseph Knight (1809) *On the cultivation of the plants belonging to the natural order of Proteeae, with their generic as well as specific characters and places where they grow wild.* Knight was gardener to George Hibbert MP, who was famous for his collection of Proteaceae, one of the largest ever assembled (Rourke 1980). When Hibbert lost interest in this collection it was given to Knight and it formed the basis of Knight's nursery business established in 1809 (Britten 1886b; Hadfield *et al.* 1980), later to become the famous Veitch's nursery (Fletcher 1969). Salisbury had obviously been on good terms with Hibbert and Knight, as many of the plants he featured in *The paradisus londinensis* had been obtained from Hibbert.

The title page of Knight's work refers only to Knight as the author and in the preface he claims that 'perhaps few works have greater claims to originality than the present, not a single line copied from any other.' However, he does say before this that to have ascertained so many generic and specific differences would have been quite impossible,

> if fortunately his labours, like those of the late Mr Aiton respecting the Hortus Kewensis, had not been thought worthy the assistance of men more learned than himself.

That the more learned help was given by Salisbury seems obvious. Within the preface Knight advocated a natural system of classification and a change of specific epithets 'when the old ones were manifestly absurd', both views held by Salisbury and setting him at odds with the establishment of the day (Britten 1886b). Knight further acknowledged R. A. Salisbury 'whose manuscripts have been found so useful in every sheet'. While much of the commentary in the work can be attributed to Knight with his specialist horticultural knowledge of the Proteaceae, Salisbury was almost certainly responsible for the generic delimitation, the short Latin descriptions and the synonymy. It may be significant that the layout is almost identical to that in his *Prodromus Chapel Allerton.*

Furthermore, in a copy of Brown's (1810b) *Prodromus florae Novae Hollandiae* extensively annotated by Salisbury (see next chapter), Salisbury has not challenged Brown's citation of authorship of Knight's work and the names therein as 'Knight & Salisb.'. Salisbury also has not commented upon Brown's assertion that discrepancies in the circumscription of the genus *Grevillea* could have arisen through a misreading of Brown's (1810a) treatise in the Linnean Society transactions (presumably in proof or manuscript form) or through Salisbury misunderstanding his lectures on the topic to the Society. This lack of comment by Salisbury suggests that he accepted Brown's view of the authorship of Knight's work; elsewhere in the volume he has often indicated his disagreement with Brown. Taking all this into account it is suggested that the authorship of the new taxa in Knight's *Proteeae* should be cited as 'Knight & Salisbury'.

In Knight and Salisbury's publication Robert Brown is credited with the authorship of a number of genera (Table III). However, other new genera described by 'Knight & Salisbury' were said to have been plagiarized from those presented by Brown to the Linnean Society; Salisbury had been present at the meetings when Brown read his paper. In his work on the Proteaceae, Brown (1810a) recognized the priority of Salisbury's names of South African genera in *The paradisus londinensis* (Salisbury 1807). In the preface to this paper, Brown stated:

> the genera into which I have subdivided the great African family Protea, are in most cases similar to those already proposed by Mr Salisbury in the Paradisus Londinensis: from that essay they are certainly not derived but before its publication were formed and submitted to the judgement of Mr Dryander .... As Mr Salisbury's generic names have the unquestionable right of priority of publication, I have in most cases adopted them, though I wish some of them had been differently constructed.

This statement referred only to the African genera. No mention was made throughout Brown's paper of Knight and Salisbury's work, possibly because Brown had not seen it before his own manuscript was finalized. Consequently, Brown provided his own names for Knight and Salisbury's Australian genera in this first essay on the Proteaceae.

By contrast, in his second treatise of the Australian Proteaceae published shortly afterwards in the *Prodromus*, Brown (1810b) cited Knight & Salisbury's work. Where generic names were attributed to him he adopted them, but he placed all Knight and Salisbury's genera into synonymy under his own later ones. This

Table III
Treatment of Salisbury's genera of Proteaceae by Robert Brown (1809) in his monograph on the family

Salisbury's genera	*Brown's name (current name, if differs)
The early genera (Salisbury 1807)	
Australian genera	
Atylus Salisb.	*Petrophila* [sic] R. Br.[1]
Atylus Salisb.	*Isopogon* R. Br.[1]
South African genera	
Mimetes Salisb.	*Mimetes* Salisb.
Paranomus Salisb.	*Nivenia* R. Br. (= *Paranomus* Salisb.)
Spatalla Salisb.	*Spatalla* Salisb.
Genera published in Knight (1809)	
Australian genera	
Stylurus Salisb.	*Grevillea* R. Br.
Lysanthe Salisb.	*Grevillea* R. Br.
Grevillia R. Br. (conserved with the spelling *Grevillea*)	*Grevillea* R. Br.
Tricondylus Salisb.	*Lomatia* R. Br. (conserved name)
Cybele Salisb.	*Stenocarpus* R. Br. (conserved name)
Hylogyne Salisb.	*Telopea* R. Br. (conserved name)
Josephia R. Br.	*Dryandra* R. Br. (conserved name)
Isopogon R. Br.	*Isopogon* R. Br. (conserved name)[1]
Petrophile R. Br.	*Petrophila* [sic] R. Br.[1]
Rymandra Salisb.	*Knightia* R. Br. (conserved name)[2]
South African genera	
Soranthe Salisb.	*Sorocephalus* R. Br. (conserved name)
Gissonia Salisb.	*Leucadendron* R. Br. (conserved name)
Euryspermum Salisb.	*Leucadendron* R. Br. (conserved name)
Chasme Salisb.	*Leucadendron* R. Br. (conserved name)
Erodendrum Salisb.	*Protea* L. (conserved name)[3]
Pleuranthe Salisb.	*Protea* L. (conserved name)[3]
Diastella Salisb.	*Leucospermum* R. Br. (conserved name)
Leucadendrum L.	*Leucospermum* R. Br. (conserved name)
Tropical American genera	
Euplassa Salisb.	(not treated by Brown; accepted today)
Panopsis Salisb.	(not treated by Brown; accepted today)

*Those genera of Brown's which have been taken up by the legal procedure of conservation over the earlier Salisbury names (see text) are indicated. Five of Salisbury's names, attributed to South African and American genera, were not overturned by Brown.

1 *Atylus* Salisb. included two named species, *Protea fucifolia* Salisb. and *Protea anemonefolia* Salisb., which are respectively types of the genera *Petrophile* and *Isopogon*. Only the latter genus was conserved against the earlier published *Atylus*. *Atylus* has priority over *Petrophile*, unless *Protea anemonefolia* is chosen as lectotype of *Atylus* or *Petrophile* is conserved over *Atylus*.

2 Brown's genus *Knightia* was not named after Joseph Knight, but after Thomas Knight, a plant physiologist and associate of Banks.

3 *Protea* predates Salisbury's synonyms; it has been conserved against the name *Leucadendrum*, a name which Linnaeus originally applied to a *Protea* under present concepts, but which by conservation is now applied to a different genus as circumscribed by Brown.

conformed with J. E. Smith's attitude to the *Proteeae*, reflected in his letter to Brown in January 1810 (Mabberley 1985, p. 156):

> I have indeed got the Proteeae, but shall not keep it — I mean hereafter not to notice it or any other of the author's productions.

Unfortunately the generic names given by Knight and Salisbury seem never to have been used except in synonymy. Brown's later published names have now been conserved for all time over Salisbury's. This probably occurred in 1905 in the early days of generic conservation when justification was not required (Stafleu 1956), but it undoubtedly resulted from long-standing usage of Brown's names, despite attempts by James Britten (1886b) to rectify this injustice.

What is often overlooked is that Salisbury's interest in Proteaceae predated that of Brown. He had after all grown Proteaceae, and described a number in 1796 in his *Prodromus* and more in the series *The paradisus londinensis* from 1805, recognizing many new species and proposing (Salisbury 1807) a new generic treatment for South African Proteaecae. There were obviously sufficient Proteaceae growing in Hibbert's garden for Salisbury to independently distinguish the Australian genera. He did in any case attribute some of the genera to Robert Brown (Table III); no doubt these were the ones he had heard about in Brown's lectures (or perhaps before from Dryander: see later) and had not distinguished himself.

It seems a pity that the contribution made by Salisbury is not more justly represented in the Australian flora. Salisbury had a broad knowledge of Australian plants through cultivation and herbarium study and was initially an active member of the scientific establishment and a friend of J. E. Smith, the influential purchaser of the Linnaean Herbarium. When his personal life came under scrutiny, his reputation as a gentleman suffered (Dawson 1958; Mabberley 1985). At the same time, in opposition to an enshrined Linnaean system (Stafleu 1971), he was advocating a natural system of classification, again well before Brown came on the scene. He was also upsetting his fellow scientists (Fletcher 1969, p. 35), notably J. E. Smith, in changing botanical names when he did not find them appropriate[3] (see many examples in Salisbury 1805–1808).

The claims of plagiarism in the *Proteeae* were possibly the final straw which led to Salisbury's withdrawal to horticultural rather than scientific pursuits. He remained active in the Royal Horticultural Society in which he played an important role. He was a founding member in 1804 and was its Honorary Secretary from 1805 to 1814. His resignation as secretary, soon after being awarded the Society's Gold Medal, resulted from claims that his assistant was derelict in his duty (Fletcher 1969).

To what extent was the lack of acceptance of Salisbury's scientific work in his lifetime influenced by problems with his personality rather than objective scientific judgement on the part of his colleagues? The subsequent failure to take up Salisbury's names or recognize his contribution to botanical classification appears to be a direct result of his ostracism.

Robert Brown's Prodromus*, an uncompleted Australian Flora*

> *I can never sufficiently express my admiration of Brown's Prodromus — it is so exceedingly accurate. It is to me a source of astonishment how he saw so many of our rarer plants. I wish he had completed it.* (Ronald Gunn[4])

The third and last of Banks's botanist-librarians,

ribus, obtectis. *Corolla* tubulosa, subbilabiata. *Stamina* didynama, inclusa: *Antherarum* lobis divaricatis. *Stigma* emarginatum. *Capsula* calyce (ut plurimùm aucto) inclusa, bilocularis, bivalvis, valvis bipartitis; dissepimento parallelo, libero; placentis adnatis.

Herbæ *oppositifoliæ*. Flores *axillares, pedunculis bibracteatis.*

Obs. Hujus loci esse videtur Lindernia dianthera *Sw.*, caret autem bracteis, quæ in Herpestidis *Gært.* icone etiam desunt.

1. H. *floribunda*, glabra erecta, foliis lineari-lanceolatis, calycibus fructiferis reticulatis subcordatis, pedunculis sub apice bibracteatis. (T.) *v. v.*

LIMNOPHILA.

Dr. with an E. jamnudum anno 1792.

Calyx tubulosus, 5-fidus, æqualis. *Corolla* infundibuliformis, limbo 5-fido, subæquali. *Stamina* didynama, inclusa: *Antheræ* per paria cohærentes. *Stigma* dilatatum, obliquum. *Capsula* bilocularis, bivalvis, valvis bipartitis, dissepimento marginibus tardiùs dehiscentibus valvularum inserto.

Herbæ *oppositifoliæ, paludosæ.* Folia *profundè incisa, sæpè 3-partita, et hinc quasi verticillata.* Pedunculi *axillares, apice bibracteati.*

L. *gratioloides.* (T.) *v. v.*
Hottonia indica. *L.*
Obs. Plures forsan species sub hoc nomine confusæ sunt, in recenti statu tantummodo extricandæ.

ADENOSMA.

Calyx 5-partitus, lacinia supremâ majore. *Corolla* ringens, labio superiore indiviso, inferiore trilobo, æquali. *Stamina* didynama: *Antheris* approximatis. *Stigma* dilatatum. *Capsula* ovata, rostrata, bipartibilis: *Placentæ* suturis adnatæ.

Herba *annua, pubescens, glandulis conspersa, odore* Menthæ, *siccata nigricans.* Spica *foliata; v. flores axillares.* Calyx *bibracteatus, pilis articulatis hirsutus.* Corolla *cærulea.*

Oryzetes – Obs. Huic genus proximum constituunt Ruellia uliginosa et balsamea:
I place this & Adenosma with Thymus & Cunila in the Order of Nelsonia.

Fig. 2. Extract from Richard Salisbury's copy of Robert Brown's *Prodromus florae Novae Hollandiae*, p. 442, showing Salisbury's reference to *Limnophila* being a Dryander name, formulated well before Brown arrived on the botanical scene. The annotation reads 'D^{r}.with an E. jamnudum anno 1792', indicating that Dryander spelt the name '*Limnophile*'.

Robert Brown, produced only one of the two volumes of his incomplete masterpiece, his *Prodromus florae Novae Hollandiae* (Brown 1810b; Fig. 2), in which he documented concisely in a natural system a large portion of the Australian plants known to that time. A complete explanation as to why Brown did not publish the second volume will probably never be given. References (Britten 1907; Stearn 1960; Mabberley 1985) cite his mortification at the lack of public interest in purchasing copies; out of 250 published, a number were given away (apparently not to Salisbury: Britten 1907) and only 26 were sold before he finally apparently withdrew those outstanding from sale in 1816, using the remainder as gifts. Suggestions that the Latin text was grammatically poor have been scotched (Britten l.c.; Mabberley l.c). Britten (1907) considered that a decline in interest in natural history works by 1817 may explain the lack of sales. More likely reasons may lie in a difficulty in understanding and using a natural system compared with an artificial one, the lack of an index, and its production in Latin giving it a scholarly rather than popular aura (Mabberley 1985). It did not conform with the popular works of the day with their emphasis on lavish illustration rather than the English text. Mabberley (l.c.) states:

> On the face of it, the 'fragment' is singularly unattractive, being a small, unfinished, unillustrated, unindexed, and indeed expensive volume in Latin, on bad paper, and poorly printed by the standards of the day.

Brown had to go into this venture with his own finances under his agreement with the Admiralty and was still apparently preparing the remainder for publication in 1816 (Mabberley 1985). Did Banks offer financial support for the completion of the work? Initially Banks had favoured the simultaneous inclusion of Ferdinand Bauer's illustrations with Brown's text. In 1806 he wrote to William Marsden of the Admiralty (reproduced in Edwards 1981a):

> Brown and Bauer should join together in publishing engravings of the most interesting objects of natural history they have collected, in a handsome form, as a periodical work, there being every reason to hope such a work will, if conducted with prudence and economy be a source of profit to these gentlemen.

Despite Banks's predictions, the 15 plates of Bauer's paintings which appeared as *Illustrationes florae Novae Hollandiae* (Bauer 1806–1813) did not sell well. Edwards (1981a) suggested that this might have arisen from the glut of such illustrative works being produced at the time and a general lack of money because of the Napoleonic wars. Soon after the publication of the *Prodromus* in 1810, Brown indicated in a letter that he still anticipated producing a Flora of New Holland (Mabberley 1985, p. 174). Yet only two weeks later he wrote (Mabberley l.c.):

> I have at present very little hope of being able to accomplish it [the Flora] as I could wish, or indeed in any manner for with respect to it there seems to be such a freezing indifference in a quarter where I hardly expected it [? Banks] as makes me think that very little is looked for from me in such an undertaking & admonishes me also of how little importance what I have already attempted is considered. My Book indeed may be truly said to be still born nor have I heard of more than one or two people were at all desirous of possessing it. [Mabberley's comment].

Within a matter of weeks Dryander died. Brown was employed by Banks as his replacement. If Banks was indeed indifferent to Brown's New Holland work, it is scarcely surprising that the second part of the *Prodromus* never appeared. At least in producing the compact *Prodromus* Brown avoided a repetition of the fate of Solander's manuscripts as well as operating within his own financial constraints. Were openings available for him to publish elsewhere, such as in serial form in the Linnean Society's transactions? Were attempts made to help or persuade him to do so, in the same way as Dryander had encouraged the publication on the Proteaceae (see above) on account of their great horticultural importance? One avenue of publication which Brown did take up was to publish a number of new genera and families in an appendix to Flinders's account of his voyage to Terra Australis (Brown 1814).

With his failure to publish his second volume, Brown lost credit for recognizing many new plants. We have not fully investigated the extent to which Brown's manuscript names have been used although there is an indication in Mabberley (1981) that J. J. Bennett may have compiled this information. Brown's manuscript may not have been as freely available as for example Solander's. Certainly there was a long delay until after the late 1870s before his herbarium was distributed and access was not given freely to his collections, in contrast to the ready accessibility of the Banks collections (Edwards 1981a). However, a few of Brown's names were taken up by others with acknowledgement in the mid 1800s, for example *Eucalyptus perfoliata* R. Br. ex Benth., *Drosera banksii* R. Br. ex DC., *Capparis lasiantha* R. Br. ex DC. and *C. lucida* (DC.) R. Br. ex Benth.

The degree of originality of Brown's Prodromus

Numerous handwritten annotations in a copy of Brown's *Prodromus* in the library of the Botanic Gardens of Adelaide have been recently found by us to be those of Richard Salisbury (Fig. 2). Many of these indicate inadequate acknowledgement by Brown of the contributions of others to his *Prodromus*.

The discovery of Salisbury's volume sheds light on the role played by others, particularly Dryander, in the recognition of taxa and the supply of names. Whether Salisbury's comments derived from personal communication or unpublished manuscripts or both warrants investigation. Salisbury's care in attributing names to the correct author, acknowledged by Britten (1916b), is evident here also. One inconsistency noted, however, is in the authorship of the genus *Grevillea*; Knight and Salisbury attributed it to Brown in their work on Proteaceae (Knight 1809), but Salisbury annotated his copy of the *Prodromus* with 'D^{r}.' for Dryander.[5] That Dryander made a contribution to the delimitation of the genera of the Proteaceae is admitted by Brown (1809) in his treatment of the family; in a reference (p. 45) to use of the Banks Herbarium he acknowledged:

> consulting my friend Mr. Dryander, both as to the formation of genera and respecting synonyms, on which points his sound judgement and unrivalled erudition so well enable him to decide.

The British Museum (Natural History) has manuscripts of Solander, Dryander and Salisbury which

Table IV

Some generic, sectional or species group names in Robert Brown's (1810b) *Prodromus florae Novae Hollandiae* for which the authorship is disputed and sometimes an alternative name provided by R. A. Salisbury, according to annotations on his apparently personal copy of the work held in the library of The Botanic Gardens of Adelaide.

Published text			*Annotation by Salisbury
Page no.	Genus name	Authorship	
Names attributed by Salisbury to Dryander in unmodified form			
149	*Allantodia*	[R. Br.]	'D^{r}.'
225	*Glossodia*	[R. Br.]	'D^{r}.'
235	*Oreobolus*	[R. Br.]	'D^{r}.'
239	*Evandra*	[R. Br.]	'D^{r}.'
263	*Calectasia*	[R. Br.]	'D^{r}.'
278	*Tricoryne*	[R. Br.]	'MS.' [D^{r}. has been erased] '[T.] Elatior flowered at Chapel Allerton in 1799'
287	*Johnsonia*	[R. Br.]	'D^{r}.'
330	*Dipodium*	[R. Br.]	'D^{r}.'
375	*Grevillea*	[R. Br.]	'D^{r}.'
412	*Deeringia*	[R. Br.]	'D^{r}.'
442	*Limnophila*	[R. Br.]	'D^{r}. with an E. jamdudum anno 1792' [i.e. *Limnophile* Dr.]
448	*Duboisia*	[R. Br.]	'D^{r}.'
480	*Nelsonia*	[R. Br.]	'So named by Dryander long before Brown even came to London who pointed out to me the seeds without retinacula'
507	*Chilodia*	[R. Br.]	'D^{r}.'
541	*Leucopogon*	[R. Br.]	'D^{r}.'
552	*Lysinema*	[R. Br.]	'D^{r}. ob filamenta a corolla plus minus libera'
553	*Cosmelia*	[R. Br.]	'D^{r}.'
—	*Velleia*:		
580	1. *Menoceras*	[R. Br.]	'D^{r}.'
Names of derivation similar to those used by Robert Brown and attributed by Salisbury to himself, Dryander or Solander			
229	*Arthrostylis*	[R. Br.]	'*Arthrogyne* D^{r}. ob euphonium'
232	*Chaetospora*	[R. Br.]	'*Chaetais* D^{r}. S^{r}.'
301	*Anigozanthos*	Labill.	'*Anigosia* [metius]'
301	*Phlebocarya*	[R. Br.]	'*Phlebidium* MSS'
320	*Microtis*	[R. Br.]	'*Microphylax* MSS. *Microtoa* jam apud Swartz'
322	*Cyrtostylis*	[R. Br.]	'*Cyrtosia* MSS.'
325	*Lyperanthus*	[R. Br.]	'[inclusus] *Lyperia* dixit Dryander [i.e. name derived from Dryander's comments]'
329	*Caleana*	[R. Br.]	'*Caleya* MSS.'
—	*Grevillea*:		
379	I.D. . . . *Plagiopoda*	[R. Br.]	'*Plagiopus*'
410	*Anisacantha*	[R. Br.]	'*Anisachne* D^{r}.'
503	*Anisomeles*	[R. Br.]	'*Anisandra* D^{r}.'
539	*Cyathodes*	Labill.	'*Cyathissa* MSS.'
548	*Trochocarpa*	[R. Br.]	'*Trochidium* MSS.'
552	*Prionotes*	[R. Br.]	'*Prioganum* MS.'
Names of derivation different from Robert Brown's and attributed by Salisbury to himself, Dryander, Solander, and others			
—	*Asplenium*:		
150	OBS.III. . . . *Aspidium fontanum* . . . *Aspidium filix feminae* . . .	—	'*Thelypteris* MS.'
151	*Doodia*	[R. Br.]	'(*Doodia* of Soland. is *Vandellia*)'
—	*Agrostris*:		
170, 171	[species 3–5]	—	'*Monarrhene* MS.'
171	[species 6, ?-9, also ?11]	—	'*Triarrhene* MS.'
180	*Eleusine*	Gaert.	'*Hippoctenium* MSS.'
—	Commelineae:		
269	OBS. . . . nec non species unguibus petalorum connatis . . . distinctum genus efformantes	—	'*Zygomenes* H. Tr. 1 p. 272'
270	*Aneilema*	[R. Br.]	'*Aphylax* MSS. Hort Trans.1.p.270 nomen autem jamdudum (in 1786) dictavit Dryander'
—	*Arthropodium*:		
276	4. *A. fimbriatum* . . . an proprii generis?	[R. Br.]	'*Hyponema* MSS. olim'
276	*Chlorophytum*	Ker in *bot. mag.*	'*Tristegia* in Laws.cat.'
280	*Luzuriaga*	Ruiz et Pavon	'*Calcoa* MSS.'
319	*Neottia*	Jacq. Sw.	'*Ibidium* MS.'
320	*Calochilus*	[R. Br.]	'*Chilopogon* D^{r}.'
329	*Caleana*	[R. Br.]	'*Elasma* MS olim' [see also '*Caleya* MSS' above]
:	*Cymbidium*:		
332	OBS. *Limodorum nutans* Roxb. Corom.	—	'*Otandra* MS.'
332	*Sarcochilus*	[R. Br.]	'*Calopus* Laws.cat.'
332	*Dendrobium*	Swartz	'*Phellobium* MS'
332, 333	[species 2, 3]	—	'*Phellobium* MS.'

Table IV — Continued

Published text			*Annotation by Salisbury
Page no.	Genus name	Authorship	
332	1. *D. undulatum*	[R. Br.]	'*Amphistegia*'
333	6. *D. linguiforme*	Sw.	'*Wilfreda*'
344	*Damasonium*	Schreb. *gen. pl.* 242	'*Hymenotheca* MSS.'
—	*Thesium*:		
353	Species Americana *Thesium umbellatum* L. charactere floris inter *Fusanum* et *Santalum* ...	—	'*Nanodea* Soland. Cfr. Gaertn. vol. 3 sub *Nanodea*' [Gaertner refers the genus to Banks]
—	*Pimelea*:		
359	[species 1, 2]	—	'*Choniphile* "genus certo" D[r].'
362	III. [species 30]	[Unnamed infrageneric group]	'*Ectasium* MSS.'
—	*Petrophila*:		
364	I.	[Unnamed infrageneric group]	'*Atylus* MSS.'
364	II.	[Unnamed infrageneric group]	'*Petrophile* MSS.'
365	III.	[Unnamed infrageneric group]	'*Symphyglos[sum]* MSS.'
365	IV.	[Unnamed infrageneric group]	'[*Choriza*] MSS.'
—	*Isopogon*:		
366	II.	[Unnamed infrageneric group]	'*Piptomone* MSS.'
—	*Grevillea*:		
376	I.A ... *Lissostylis*	[R. Br.]	'*Lysanthe*'
378	I.B ... *Ptycocarpa*	[R. Br.]	'*Opiza* MSS.'
378	I.C ... *Eriostylis*	[R. Br.]	'[*Hythrus*] MSS.'
379	28. *G. asplenifolia*	Knight & Salisbury	'*Cyathema* MSS.'
379	30. *G. chrysodendrum*	[R. Br.]	'*Cyathema* MSS.'
380	?34. *G. mimosoides*	[R. Br.]	'*Gyale* MSS.'
380	35. *G. polystachya*	[R. Br.]	'*Gyale* MSS.'
438	*Centranthera*	[R. Br.]	'*Chelandra* S[r].'
—	*Adenosma*:		
442	OBS. Huic genus proximum constituunt *Ruellia uliginosa* et *balsamea*	—	'*Oryzetes*. I place this & *Adenosma* with *Themon Corea* in the Order of Nelsoneae' [see also pp. 478, 479]
—	*Orthostemon*:		
451	OBS. Genus medium inter *Canscoram* Lam. ...	—	'(*Aspasia* MSS est *Canscora* Lam.)'
—	*Sebaea*:		
452	I. *S. ovata*	[(Labill.) R. Br.]	'*Aphelogyne* stylo uni strumoso'
—	*Mitrasacme*:		
454	II.	[Unnamed infrageneric group]	'*Dichomene* ...'
454	III.	[Unnamed infrageneric group]	'*Ameriza*'
454	IV.	[Unnamed infrageneric group]	'*Exoterpe*'
—	*Villarsia*:		
456	I.	[Unnamed infrageneric group]	'*Limnanthes* MS? seu forte potius *Madonais* MS que *M. Indica* L.'
—	*Cynanchum*:		
463	*C. pedunculatum*	[R. Br.]	'*Echyra* Dryand. MSS'
463	*C. floribundum*	[R. Br.]	'*Echyra* Dryand. MSS'
—	Apocineae:		
468	Sect. III.	[Unnamed infrafamilial group]	'Randolfae MSS'
469	Sect. IV.	[Unnamed infrafamilial group]	'Randolfae. Per. 2-dymum, nunc drupaceum'
—	*Justicia*:		
475	Ringentes calyce 4 partito ...	[Unnamed segregate]	'*Lactandra* MSS.'
476	Sectio. 3tia	[Unnamed section]	'*Dizygium* MSS.'
476	I. [species 1–3]	[Unnamed group of species]	'*Lactandra* MSS.'
476	*Eranthemum*	Linn.	'*Coelosporum* MSS. [*Eranthemum* L. ...] est aliud genus'
—	*Ruellia*:		
478	*R. macrophylla*	Vahl	'*Heniochе* MSS.'
478	*R. balsama* et *uliginosa*	—	'*Oryzetes* MS' [including *Ruellia* 3-flora Roxb. Ic. 1150; see also p. 442]
479	*R. depressa* et *spinescens*	—	'*Themon* MS'
479	*Ruellia ovata*	Thunb.	'*Corea* MS.'
496	*Tournefortia* [Boragineae]	L.	'Tourneforteae Ord. mihi'
497	*Ehretia*	L	'ad Tourneforteae'
508	*Prostanthera*	Labill.	'*Euplectrum* Laws.Cat.'
—	*Myoporum*:		
516	III.	[Unnamed infrageneric group]	'*Andrewsia*' [no author: on prior page Brown has *Andrensia* (sic) Vent.]
524–528	Ebenaceae	Juss.	'Diospyreae MS.'
—	Epacrideae:		
537	[next to *Styphelia*]	[infrageneric group]	'*Sprengeleae* 2-bract. Per. caps. 5 valve'
		[infrageneric group]	'*Epacrideae* multi bract. Per. caps. 5 valve'
		[infrageneric group]	'*Stypheleae* multi bract. Per. drup. evalve'
		[infrageneric group]	'*Leucopogeae* 2-bract. Per. drup. evalve'

Table IV — Continued

Published text			*Annotation by Salisbury
Page no.	Genus name	Authorship	
540	[above *Lissanthe*]	—	'Sect.3. *Leucopogeae*'
547	*Acrotriche*	[R. Br.]	'*Acropogon* MSS. Dr.MSS'
—	*Lysinema*:		
552, 536	sp.5. *L .pungens*	[R. Br.]	'*Dolon* Dr. ob facium *Epacridis*.'[On p. 536] '*Dolon* Dr. differt a *Lysinemate* corolla 1-petala facie proxima *Epacridis* unde nomen'
—	*Campanula*:		
561	1. *Camanopsis*	[R. Br.]	'*Hemithyra* [Sr.]'
579	*Euthales*	[R. Br.]	'Sol.nomen ad aliud genus'
:	*Scaevola*:		
585	12. *S. microcarpa*	Cav.	'*Hemicharis* MS'

* In the few cases where Salisbury has cited publications with alternative names, it has yet to be established if these pre- or post-date the *Prodromus*. 'Lawson's Catalogue' is apparently an unpublished list not known to exist today (Mabberley 1980).
Abbreviations: R. Br., Robert Brown; Dr., Dryander; Sr., Solander; Laws., Lawson; MS or MSS without an authority presumably refers to a Salisbury manuscript, possibly the one in the British Museum (Natural History).
Generic and infrageneric names used in Salisbury's annotations are placed here in italics.

Table V

Statements and concepts in Robert Brown's (1810b) *Prodromus* which, according to annotations made by Richard Salisbury in a copy of the book held in the library of The Botanic Gardens of Adelaide, came from other botanists, mainly Dryander, but also Correa and O. Swartz*

Page no.	Published text [or summary]; underlining and asterisks by Salisbury are shown	Annotation by Salisbury	Translation of comment
161	Osmundaceae [diagnosis]	'Dryander told me that he separated this Order for their reticulated capsules'	
163	Ophioglosseae . . ./Capsulae *uniloculares, basi adnatae, subglobosae, coriaceae, opacae, exannulatae* . . .	'Hac fruct diagnosis Dryandri'	This diagnosis of the fruit by Dryander
169	Gramineae. [Remarks on generic composition and distribution of the infrafamilial groups]	'Most of these remarks relative to the geography of the grasses were made by Dryander, being before the author returned from New Holland'	
205	Colladoa *Cavan. l.c.* genuina species Ischaemi est, ut patet ex figura, et descriptione mutatis partium nominibus	'Sic dixit Dryander jamdudum . . .'	So said Dryander long before
270	Aneilema [R. Br.]	'Aphylax MSS. Hort. Trans. 1 p. 270 nomen autem jamdudum (in1786) dictavit Dryander'	Aphylax MSS . . . a name moreover long ago (in 1786) Dryander said often
311	Orchideae . . . OBS. III. Quoniam in Cypripedio habemus columnae lobos laterales antheriferos intermediumque sterilem, fas est reliquorum generum lobos laterales . . .	'Sic dixit Correa anno 1800'	Correa said this in the year 1800
320	Microtis [R. Br.]	'Microphylax MSS. Microtoa jam apud Swartz'	. . . Microtoa already in the writings of Swartz
325	Lyperanthus [R. Br.]	'Lyperanthus [inclusus] Lyperia dixit Dryander'	. . . included Lyperia said Dryander
400	Myristicaceae . . . OBS. II. [relations of *Knema* and *Myristica* etc.]	'Affinitatem cum Myristica jamdudum [?]it Dryand. in 1798'	Dryander [noted] the affinity with Myristica long before in 1798
442	Limnophila [R. Br.]	'Dr. with an E. jamdudum anno 1792'	Dryander's name spelt Limnophile long before in the year 1792
450	Gentianeae . . . OBS. [Paragraph concerning *Ophiorrhiza mungos* being in Rubiaceae close to *Oldenlandia; Mitreola* should be retained]	'Sic Dryander anno 1796'	Dryander [stated this] in this way in the year 1796
480, 481	Nelsonia [R. Br.] . . . Semina sine retinaculis . . . Dixi in memoriam DAVIDIS NELSON Hortulani meritisimi, qui in ultimo itinere Cookii plurimas novas species plantarum detexit . . .	'So named by Dryander long before Brown even came to London, who pointed out to me the seeds without retinacula'	
533	Myrsine L. . . . OBS. Hujus generis sunt Myrsine africana . . . *Manglilla Juss.* . . . ×Samara	'×"Samara est affinis Myrsine" Dr. in 1806, & long before when Swartz was here'	Samara is allied to Myrsine . . .
534	Myrsineae: Aegiceras Gaert. Koenig . . . OBS. . . . Jacquinia venosa *Sw.* diversissimi generis et etiam ordinis, nam Rubiacea est	'Sic dixit Dryander olim ante reditum auctoris in 1805 mense Octobris, veram affinitatem [Rizieeratis]'	So said Dryander in the past, before the return of the author [Brown] in 1805 in the month of October . . .

* Swartz, a Swede, worked in London in 1786–1787 (Stafleu & Cowan 1976–1978).

may shed light on this as well as provide confirmation of Salisbury's comments. These comments also need to be compared with published comments made by Salisbury in reviews to Brown's work (Mabberley 1980) which we have not seen.

Salisbury has attributed to Dryander authorship of 16 generic names and one infrageneric name which have always been attributed to Brown (Table IV). Brown, according to Salisbury, also used without acknowledgement six of Dryander's generic names in modified form (Table IV); one of these Salisbury also attributed to Solander. A number of other genera which had been recognized in manuscript or publication were also noted by Salisbury. We have not yet ascertained whether these predate the *Prodromus*.

Furthermore, Salisbury has alleged plagiarism by Brown of specific taxonomic concepts proposed by Dryander and others some years before Brown became established as a botanist (Table V; Fig. 2). Brown appears generally to have been very careful to acknowledge the contributions of others in his notes under the various taxa in the *Prodromus*. However, there is a complete absence of reference to Dryander's contribution to such concepts as the significance of the absence of the seed stalks of *Nelsonia* (Acanthaceae: Table V) and the geo-climatic relationships of the tribes of the grass family. When one also considers the alleged use of Dryander's manuscript names (Table IV), Brown could hardly have forgotten to acknowledge all of them. In view of the close relationship of the two botanists, who worked together for two days each week on the Australian flora after Brown's return from New Holland (Edwards 1981a), it is remarkable indeed that Dryander's name does not feature in the *Prodromus*.

Solander's name is likewise mentioned rarely in the *Prodromus*. It is limited to a few references under individual species to the 'Banks & Solander' manuscript; the genera *Sebaea* and *Hypoestes* are attributed solely to Solander by Brown. Solander's death 30 years before the *Prodromus* was published could hardly have excused Brown's ignoring his contribution. As has already been shown, he had made extensive use of Solander's manuscripts and the Banks and Solander herbarium.

Brown's fellow collectors on the voyage of the *Investigator*, Peter Good, the gardener and seed collector, and John Allen, the 'miner', are also notably unacknowledged in the *Prodromus*. Although at times Good collected independently of Brown (Edwards 1981b; Clarkson 1988), his specimens were incorporated without annotation within Brown's own herbarium and under his own labels (Edwards 1981b).

Who did Brown acknowledge in the *Prodromus*? There is mention in the preface of just two land-based collectors King and Paterson and of the voyagers Dampier, Lechenault (sic), Riedley (sic), Baudin, Menzies and Labillardière. His shipmate the artist Ferdinand Bauer is mentioned. In the relevant part of the text he gave credit to a number of contributions by fellow scientists.

Brown went to extreme lengths to acknowledge the contribution of Banks to his work. He mentioned him on the title page, in a full-page dedication, several times in the preface (as 'Illust. Banks'), in occasional references to the names of 'Banks and Solander', and in the citation 'B' indicating collections made by Banks and Solander. He was surely justified in his gratitude to Banks, but by today's standards this is disproportionately given.

Brown was undoubtedly driven to acknowledge Banks extravagantly for social, political and financial reasons. After all, at this time Banks was the influential leader of the scientific establishment. Without his sponsorship Brown may never have been or continued as a botanist. It was Banks's influence which gave him the opportunity of participating in Flinders's voyage which had embarked him upon his scientific career. After Dryander's death in 1810 Brown relinquished his employment with the Admiralty to succeed to the esteemed position of Banks's botanist-librarian. The *Prodromus* therefore was his first major publication and also came at a crucial time when he was cementing his place in the scientific world. It is noteworthy that 20 years later in his *Supplement* to the *Prodromus* on the Proteaceae, Brown (1830) listed on the title page collectors of the day who had assisted him and acknowledged assistance under the treatments of individual taxa in the text where collections or manuscript names of others were used (see next section). While Brown omitted to acknowledge contributors to his *Prodromus*, the situation was different later. Not only had Brown had no opportunity to collect further specimens, but, more importantly, he had also earned his botanical spurs to such an extent that he was revered by the scientific community, particularly on the continent.

It may not be coincidental that it was the two Swedes Solander and Dryander whose work invariably appeared without acknowledgement under the authorship of others. The knowledge and skills of these disciples of the great Linnaeus were needed by the English scientific establishment which sponsored their service in London. Rather than being equals of the members of this establishment, it is possible that they were considered the servants of Banks and, as a result, their manuscripts and ideas belonged to him and were fair game to those he favoured.

In contrast, Banks's third botanist-librarian was not foreign, and attained this position in his employer's years of decline in health. With the death of Banks in 1820, Brown was able to assume his botanical mantle. Had Brown worked under Banks at the height of his influence and ambition he would possibly have been treated in a similar fashion to Solander and Dryander.

C. The first resident collectors

An early attempt by Banks to place seed collectors in the colony of New Holland foundered (Finney 1984). George Austin and James Smith, both Kew trained, were the first two gardeners to be sent to the new colony in 1789 on the ill-fated voyage of the *Guardian*. They were in charge of a number of agriculturally important plants on the ship which had been specially fitted out for that purpose. They were to stay in New South Wales and send back plants and seeds for Banks and for Kew Gardens. Unfortunately the *Guardian* hit an iceberg on the outward voyage and the two gardeners, having abandoned ship, were never seen again.

At this time seed collectors could expect some financial reward (Finney 1984). Austin had apparently con-

tracted to send back seeds to a number of London nurseries despite Joseph Banks orders to the contrary. Finney (l.c.) also records that Governor Phillip had written to Banks in November 1788 that the person employed to collect seeds (presumably a convict) had sold most of them to people returning in the convict transports. Judge-Advocate David Collins made a similar complaint about convicts selling plants and animals (Cavanagh, this volume).

Twenty years later, in 1817 following his collecting expedition with the explorer John Oxley, Allan Cunningham wrote to Banks (reproduced in Gilbert 1986, p. 31) that convicts had collected 'ample Duplicates of many of my very interesting and valuable Seeds and bulbs . . . chiefly with a view of turning them to Cash, upon their return to Sydney'. These were believed by Cunningham to be in the possession of several wealthy people 'who intend to transmit them to their friends in England by the earliest opportunity'.

Thus the first exploitation of Australia's natural resources began early in the history of white settlement, with convicts collecting natural history items for financial gain. It will be shown that officers too collected for this reason, but they also sought scientific prestige and favour from patrons.

The Banksian collector George Caley recorded that Governor King had claimed all his natural history collections and journals (Currey 1967). In refusing to hand over his own collections, Caley said (p. 47):

> I cannot contrive what he wants such articles for unless they are designed as presents, whereby his name may be accorded in the annals of natural history, or for the public's benefit. But he has plenty of people at his call without bothering me. There is a person by the name of Lewin whom the Governor has had collecting for him, but I believe they now disagree, as he has not been able to collect him as much as he expected. There is also a person by the name of Gordon (who I knew when he worked in Chelsea Gardens) who is employed by Col. Woodford as a botanical collector; the Gov. has also applied to him to collect for him but he at once refused.[6]

Collectors within Australia in the 19th Century generally fall into two broad categories. Those who collected and recognized new plants and were capable of providing names will be dealt with in this section, while those who merely collected plants and then sent them to somebody else for naming are treated in a later section. In the main, the first group failed to publish their findings. As a result there is a predominance of early botanical names provided by European botanists who had never seen the plants they described in their natural habitat.

D. Collectors supplying manuscript names or diagnoses

William Paterson (1755–1810)

According to Gunn & Codd (1981) William Paterson was born in Montrose, Scotland, trained in horticulture at Syon House, London and was sent to southern Africa as a botanical collector in 1777. On his return to England Paterson obtained a commission in the 98th Regiment and spent 1781–1785 in India. He returned to Montrose in 1785 and occupied his time in producing an account of his African journeys.

William Paterson arrived in New Holland in 1791 as a captain in the 102nd Regiment. He had asked Banks to support his application to become a Fellow of the Royal Society before leaving England (Dawson 1958, D.T.C. 7.181). Banks advised him to postpone his application until he had been able to 'advance Natural History', suggesting that his departure for New South Wales would provide him with a good scope for discoveries (Dawson l.c., D.T.C. 7.182). Not only did Paterson collect natural history items for Banks but he also supplied seed to the Lee and Kennedy (Willson 1961) and Colvill (Andrews 1812, pl. 375) nurseries. While based on Norfolk Island he compiled an account of the flora and entrusted this to Banks. The manuscript is believed to be that in the Dixson Library collection[7] in Sydney. While it was undoubtedly useful for its time, it reveals that Paterson had only a limited knowledge of botany. He used only generic and common names, not binomials. On the basis of the botanical treatment for Norfolk Island Paterson asked for membership of the Royal Society. He wrote to Banks:

> In a letter to Gov. King you are so good as to offer me your assistance in publishing the Natural History of Norfolk Island, but my return from that place put it out of my power to finish what I first intended viz. The Birds and Fishes. However with the drawings &c. that accompany's this you will be in possession of the Botanical part, and from the few specimens of the strata which were sent before, you will be able to judge of the formation of the Island.
>
> Should you think the memorandums worth publishing or if it could be done by offering them to the Royal Society I would consider the Honor still greater, at the same time may I beg to solicit your interest of becoming a Fellow of the Society and hope by my attention to Natural History you will think me deserving of that honor.[8]

Banks declined to nominate Paterson for membership of the Society until his return to England. It was thus 1797 before Paterson was elected a Fellow (Finney 1984).

George Bass (1771–1803)

While more renowned for his explorations, Bass continued the tradition of other naval surgeons serving in Australia such as John White, Denis Considen and Archibald Menzies in being a keen observer and collector of Australian natural history curiosities. He too forwarded to Banks those items which survived his arduous voyages:

> In this voyage of fourteen weeks I collected those few plants upon Van Diemen's Land which had not been familiar to me in New South Wales, and have done myself the honour of submitting them to your inspection.[9]

Along with Paterson, he was made an honorary member of the Society for Promoting Natural History, which later merged with the Linnean Society (Finney 1984). Some of his observations were published in the second volume of David Collins's *An account of the English colony in New South Wales.* There is apparently an unpublished manuscript on the wombat within the Banksian papers held in the Mitchell Library, Sydney (Bowden 1952).

Archibald Menzies (1754–1842)

While on Vancouver's round world trip from 1791 to 1795, Archibald Menzies collected in 1791 at King Georges Sound, now Albany. The ship was based there for a fortnight which gave him

> the opportunity to examine the Country in various excursions around the Sound making a copious collection of its vegetable productions, particularly the Genus *Banksia* which were there very numerous.[10]

On his return to Britain Menzies curated his plant collections, comparing them with specimens in both the Banks and Linnaean collections. It is obvious that he recognized the difference between *Hakea* and *Banksia* as all the *Hakea* collections were labelled *Banksia spuria* Menz. with an appropriate distinguishing number. Thus *Hakea trifurcata* was 'Banksia spuria Menz. No. 8', *H. elliptica* 'Banksia spuria No. 7, Menz.' and *H. ceratophylla* 'Banksia spuria No. 6' (Savage 1964). From these annotations it is clear that he recognized the different species amongst the hakeas he saw. *Banksia coccinea* was also considered a different taxon, being annotated as 'Embothrium, No. 1 latifolium'.

Menzies may have been following the generic concepts of the day in coining this name. James E. Smith (1808, p. 118) said of the early collections of Proteaceae that:

> the many new kinds of Proteaceae, though by the judgement of Sir Joseph Banks and Dr. Solander readily separated from *Protea* itself, were not rashly subdivided into too many genera, till time, and an opportunity of observing them in different states, should throw sufficient light on the subjects. Some of them indeed, constituting a clear and certain genus, were made known to the younger Linnaeus by means of plates, and dried specimens, and named by him *Banksia*, but a number of doubtful species have remained unsettled under the temporary denomination of *false Banksiae* in the collections of those who had the opportunity of acquiring New Holland specimens.

In the Savage (l.c.) catalogue mention is made of a manuscript by Menzies. The original Menzies herbarium and the Menzies manuscript need to be investigated further to establish the extent of his contribution to the establishment of new species that were based at least in part on his collections. Thus James Smith attributed the name *Banksia grandis* to Menzies (Savage l.c.). However, Willdenow, who exchanged material with Smith, is always taken as the sole author of this species (e.g. George 1981a).

George Caley (1770–1829)

George Caley arrived in New Holland in 1800. Banks had asked for permission to send Caley to New South Wales in a letter to the Colonial Office in 1798 (reproduced in Currey 1967, p. 47):

> I have with me a young man who has for more than three years studied practical botany and horticulture under my directions, and who has, without the advantages of what is called a liberal education, made a considerable progress in both these branches of useful knowledge . . . As I am unwilling to recommend to the Government any person as a botanist who has not received a scientific education . . . I am desirous of taking upon myself the payment of his salary, for which he will, I have no doubt, make me a competent return.

Unlike other collectors Caley was not constrained to collect only for Kew Gardens and Banks but was also given permission to sell specimens to others (Dawson 1958[11]). He appears to have entered into some agreement with the Colvill nursery at least.

Caley established species limits and provided provisional names. Referring to the specimens which he had sent, he stated in his first letter to Banks (reproduced in Currey 1967, p. 39) that:

> I have met with several genera which appear to be numerous in species. In my remittances I have prefixed names to those plants that I have examined. I have not done it merely with an intent of their becoming standard ones, but for being less burthensome to my memory, as I find that figures tend to perplex if I use them in all cases. I do not doubt but what many of them inapplicable; yet, as far as I have been able, I have abided by some expressive character.

A few months later he was writing (Currey 1967, p. 65):

> I have sent enclosed with the letter a few descriptions of plants which, though appearing in a rude manner for the present, may be depended upon as accurate. I have used the language of Dr Withering, as being the most familiar to me. When I found a generic description was wanted I have given it in full . . . a learned botanist could easily put them in a learned language and shorten or lengthen them as he thinks proper.

In reply Banks in 1802 (reproduced in Currey l.c., p. 66) stated:

> Your descriptions of plants do you credit. Though roughly drawn they show an attention to the structure of the plants you have described, from which the botanist of perfect education may derive advantage.

By 1804, however, Caley (Currey l.c., p. 71) was to say to Banks:

> I have tried of late to use the language of Linnaeus in making descriptions, but I have to lament that this is above my reach, and I am afraid it will not be so easily understood.

A list of Caley's plants is included in Brown's unpublished manuscripts in the British Museum (Natural History) (Edwards 1981a). We have found no evidence of Caley's names being taken up. He is commemorated in *Caleana* and several specific epithets (Maiden 1908b).

Allan Cunningham (1791–1839)

> *I am perfectly certain that the Lilies are undescribed . . . It is likely enough that Cunningham knew them: but very few of his plants are published, and if unpublished they are new to the Botanical World.* (John Lindley to Thomas Mitchell[12])

The last of the collectors engaged by Joseph Banks on behalf of Kew Gardens was Allan Cunningham. According to his biography by McMinn (1970), he was the son of a Scottish gardener and was employed at Kew Gardens from 1810 or 1811 as assistant to W. T. Aiton in the preparation of *Hortus kewensis*. When Banks sought collectors for overseas duty in 1814 from amongst the Kew staff, Cunningham applied and was granted the appointment. Following two years' work in Brazil as a botanical collector, Cunningham was assigned to New South Wales, where he arrived in

December 1816. He brought with him a manuscript copy of Robert Brown's *Prodromus*.

Allan Cunningham left Australia in 1831, having made copious collections in both Australia and New Zealand. He had collected on Surveyor-General Oxley's Lachlan River expedition of 1817, on Phillip Parker King's coastal surveys between 1818 and 1822 (Curry & Maslin, this volume), within New South Wales from 1822 to 1825, within New Zealand in 1826 and on the Darling Downs in 1827. On his return to England, Cunningham resided near Kew and worked on his collections (McMinn 1970).

Cunningham provided names for plants he considered to be new. These are still to be seen today on his herbarium collections. Most of his manuscript names of Australian plants that reached publication appear in papers by various authors in the serials Hooker's (1829–1833) *Botanical miscellany* and de Candolle's *Prodromus* (1823–1873), while some were taken up by later authors. Accordingly the majority of his published names have authorship in the form 'Cunningham ex ...', such as in *Eucalyptus sideroxylon* Cunn. ex Woolls, *E. acaciodes* Cunn. ex Maiden and *E. deglupta* Cunn. ex Maiden. In his appendix to Philip Parker King's voyages, Cunningham (1827) described no new plants, despite drawing up his own descriptions and supplying names in manuscript (Forbes *et al.* 1988). Instead he confined himself in publication to comments on individual families and left it to Brown to publish his new species. Unfortunately, Brown only ever treated the Proteaceae in his *Supplement* to the *Prodromus* (Brown 1830).

The only Australian names Cunningham published himself appear to be those contained in the *Appendix* to Barron Field's *Geographical memoirs of New South Wales* (Cunningham 1825, e.g *Stackhousia linariifolia* Cunn.). One is more likely to come across Allan Cunningham's names in the New Zealand flora on which he produced a series of papers (Cunningham 1837–1840) encompassing 589 taxa (Allan 1961).

Charles Fraser (? -1831)

Charles Fraser arrived in Port Jackson in 1816 initially as a soldier, and became the first Colonial Botanist and Superintendent of the Botanic Gardens in New South Wales. He collected plants with Allan Cunningham on Oxley's 1817 expedition and at Moreton Bay in 1828 (McMinn 1970). He was also quite capable of recognizing new species but there seems to be no evidence that he actually supplied names for them. The one exception encountered, *Castanospermum australe* Cunn. & Fraser ex Hooker, involves collaboration with one who frequently coined names. In his journal, reproduced in Hooker's *Botanical miscellany*, Fraser (1830a) said of the base of the Darling Ranges in Western Australia:

> The variety of plants seen on this tract was great: among the new ones observed, I may enumerate seven Hakea, a species of Lambertia, four species of Isopogon, three species of Leptospermum, a species of Petrophila, and a Liliaeious plant not seen in flower.

Of collecting at Moreton Bay, reproduced in the same publication (Fraser 1830b), he said:

> I ascendend Minto Craigs, where I found an unpublished species of Acacia, one of Hovea, Lasiopetalum, Croton, Leptospermum, of Aspidia and Alyxia ...

In letters to W. J. Hooker, reproduced in *Hooker's Journal of Botany*, James Drummond (1840, 1842) referred to 'Among the *Hakeas*, Frazer's *cristata*', '*Xylomela* ..., I suppose *occidentale* of Frazer', *Dryandra bi[p]innata* of Frazer', '*Diplophragma bipinnata* of Frazer', and '*Anigozanthus latifolia* of *Frazer*' (Table VIII). The first four of these species were published by Robert Brown in 1830 in his Supplement to the *Prodromus*, based on collections supplied by Fraser; the third and fourth names obviously refer to '*Dryandra* (*Diplophragma*) *bipinnatifida*' in this work. There is no indication in the Brown publication that Fraser supplied these names.

The possibility that Drummond was referring to Fraser only as collector of these species is discounted with the case of the *Anigozanthos* species. There is no evidence that 'Anigozanthus latifolia' was ever published (cf. *Index kewensis*; Geerink 1970; Hopper 1987). Fraser's 'red and green' kangaroo paw was later named *A. manglesii* by the British botanist D. Don in 1835. What then was Drummond's source of the name? It may have appeared in one of Fraser's manuscript reports on the Swan River Colony, a copy or extract of which could well have been available to Drummond in his capacity of Government Naturalist in the newly founded colony from 1829. Fraser's several reports on the region were part of Captain James Stirling's 1827 survey of the Swan River area with the view to settlement (Finney 1984); of these at least two were published (Fraser 1830a; the other in the 1829 *Quarterly review* cited by Finney l.c.), while another was read to the Linnean Society. Drummond's passage to the colony from England in 1829 was with the *Parmelia* and *Sulphur* under the command of Stirling (Erickson 1969), who presumably would have made his reports available to the settlers. There are no new binomials by Fraser in the above published extracts from his reports but they may appear in reports accompanying Stirling's case for the establishment of a colony.

A list of Fraser's collections on Oxley's expeditions and a list of plants from the Swan River and Moreton Bay are contained amongst Brown's unpublished manuscripts (Edwards 1981a).

William Baxter (fl. 1823–1829)

Little is apparently known of William Baxter who collected in Western Australia in 1823–1825 and in 1829. His itinerary elsewhere along the southern coast of Australia is poorly documented (R. Grandison, unpubl.). Allan Cunningham, on a Baxter collection of *Hakea ulicina* in the Meissner Herbarium in New York, stated that Baxter had noted it as coming from Twofold Bay. Although Cunningham considered that the location may have been erroneous this locality falls in the range of this southeast Australian species. Grandison (pers. comm. 1989) has since been able to confirm from shipping records that Baxter did visit Twofold Bay.

Before his arrival in Australia Baxter was employed as a gardener to the Contesse de Vandes at Bayswater (Sweet 1827–1828, t. 56). While in Australia he was employed by a Mr Henchmann, obviously an importer

of New Holland plants as there are numerous references throughout Sweet's (1827–1828) *Flora australasica* to Mr Henchmann's collector, Mr Baxter. He also sent seeds to other nurserymen according to his remark in a letter addressed to Charles Fraser of the Sydney Botanic Gardens wherein he commented (Maiden 1909) that 'it will take up too much time to put up my seeds to the different parties I wish to send them to'.

Baxter did provide names for at least some of the specimens he supplied: *Banksia dryandroides* and *Banksia brownii* are both attributed to him, the first by Sweet (1827–1828, t. 56) and the latter by Brown (1830), who obtained the name in a letter. The specimen of *Hakea ulicina* in the Meissner Herbarium mentioned above had been annotated by Allan Cunningham 'Hakea stenophylla Baxter mss.' As with Fraser, James Drummond also attributed names to Baxter (Table VIII). Whether Baxter supplied any other names is not known. Again there is a list of Baxter collections for 1823 and another for 1830 among Brown's manuscripts (Edwards 1981a).

Ronald Gunn (1808–1881)

Much has been written on the Tasmanian collector Ronald Gunn (e.g. Burns & Skemp 1961; Buchanan 1988, this volume) who made rich collections in Tasmania and a few in parts of Victoria. His specimens for the major part were sent to W. J. Hooker, accompanied by copious notes ('I have written Sheets of Remarks on each as usual': Burns & Skemp l.c., p. 75). Gunn had, however, an obvious talent for distinguishing species in the field. He supplied each species he came across with a unique number which should not be confused with a collection number (Burns & Skemp 1961; Haegi 1982). For example, in tackling the problems of *Euphrasia collina* and its allies, he noted on one of his collections of the subspecies *tetragona* in the Hooker Herbarium:

> This very beautiful species is very common in sandhills, &c. in the neighbourhood of the sea at Circular Head and Woolnorth, flowering during the latter part of October and early in Novb. In my earlier collections I am afraid I have sadly confounded different species of Euphrasia, and, to commence clearing up matters, I give this a new number to begin with.[13]

Only four examples of Gunn supplying manuscript names have been found: *Correa ferruginea* Gunn ex W. J. Hook., now placed under *C. lawrenciana* W. J. Hook., *Blandfordia backhousii* Gunn ex Lindley, now *B. punicea* (Labill.) Sweet, *Boronia citriodora* Gunn ex J. D. Hook., and *Macdonaldia antennifera* Gunn ex Lindley, now *Thelymitra antennifera* (Gunn ex Lindley) J. D. Hook. That he provided few names may be explained by his comment to W. J. Hooker (Burns & Skemp 1961, p. 75):

> Backhouse used to say — Better give a plant a wrong name than none at all, but I am not inclined to follow that principle as I find erroneous names once given most pertinaciously adhere — whereas a plant without a name is ready to receive the true one.

This attitude may reflect Gunn's different background from those collectors dealt with previously. All of them had been exposed to the learned scientific societies, to Kew Gardens or to the nursery trade. Gunn's interest in natural history seems only to have arisen after his arrival in Tasmania and dated from his introduction to Robert Lawrence. Lawrence too had no formal training in botany or zoology, but throughout his diary (Burns & Skemp 1961, p. 5) he apparently used Linnaean binomials. Like Gunn, Lawrence included quite detailed descriptions, after the Linnaean system, of species which he considered to be new. He died young, before he could make a substantial contribution to natural history.

Gunn's field observations and distinguishing characters undoubtedly assisted the Hookers of Kew greatly in delimiting and describing many Tasmanian species. This is reflected in the number of species they named after him. Today, in a different era, he might well have been offered co-authorship of many of the species he distinguished.

James Backhouse (1794–1869)

A Quaker missionary and York nurseryman, James Backhouse visited the Australian colonies between 1832 and 1838 enquiring into the welfare of convicts. He collected in every colony. As well as publishing extensively on his travels (Baker 1869; Maiden 1908a,b), he produced two botanical works. The first was an account of the food plants of Tasmania (Backhouse 1834; also Hooker 1836). The second was a florula of the island (Backhouse 1835), 'aided by Mr Ronald Gunn' according to W. J. Hooker (1837) in the introduction to the reproduction of this work. Gunn himself made no such claim in correspondence with Hooker (Burns & Skemp 1961). Both works were published in Ross's *Almanack*. No new species were described, but comments were made on species concepts. Many of Backhouse's collections were described by W. J. Hooker who, with William Harvey, named the genus *Backhousia* after him. Joseph Hooker and Ferdinand Mueller also named species after him (Maiden 1908a). There are apparently two manuscript volumes of his at Kew entitled 'Botany of New South Wales' (Maiden 1908b) and it would not be surprising if manuscript names were used in view of Gunn's above-quoted statement on the desirability of giving plant names. Indeed, the Tasmanian species *Craspedia alpina* of Backhouse was published by J. D. Hooker (1847) from a Backhouse manuscript (probably that cited above) in the Hooker herbarium.*

James Drummond (1784–1863)

According to his biographer Erickson (1969), James Drummond, while a young man, was curator of the Cork Botanical Gardens in Ireland and collected in the Kerry Mountains. He was elected a member of the Linnean Society in 1810. In 1829 Drummond arrived in the Swan River Colony as the honorary Government Naturalist. For some years he conducted the Botanic Garden. However, when financial support for this project was withdrawn, he transferred to the Hel-

* Note added in proof — A recent article on James Backhouse [P. Davis, *Archives Nat. Hist.* (1989) 16: 247–260] confirms that Backhouse did use manuscript names. In his 2-volume *Recollections of the Botany of New South Wales, Van Diemen's Land and their Dependencies* there are 63 names given to species he regarded as new. None of these were ever published by Backhouse, although *Craspedia alpina* and *Drosera auriculata* were both attributed to him by J. D. Hooker.

ena Valley and in somewhat straitened circumstances embarked on a career as a botanical collector, collecting seeds and sets of dried plants for sale in Europe.

Drummond was not only a prolific collector but also had a discerning eye for the species making up a spectacular flora, writing informatively about the differences between the species he collected. As well as assisting Drummond with collecting, it seems that many of his family were involved to some extent in the business of recognizing new taxa. Thus in one of his initial letters to Hooker (from Drummond 1840) he wrote:

> My family, although they know little of the science of botany, are several of them well acquainted with most of our plants and have paid a good deal of attention to the orchideae, and we have gathered between sixty and seventy species . . . My youngest daughter Euphemia knows the Swan River Orchideae quite as well as I do myself. She is able to tell any of her brothers who pick up an Orchis whether there is any chance of its being what we call a new one or not. Some of our genera, for we found it necessary to make genera to help in distinguishing the different species, turned out to be exactly the same with Mr Brown's.

Later in response to the arrival of some plates with the *Journal of Botany*, he wrote (Erickson 1969, p.67):

> The very first of the detached plates you sent me which we happened to look upon was immediately recognised by my daughter Euphemia, as one of her plants which she was the first to discover and she is quite delighted that you have thought it worthy of publication.

Drummond did use binomials, but only on a fairly limited basis and usually for spectacular plants. Most of his own names were published as reproductions of his letters to W. J. Hooker in the various journals Hooker edited at the time. For example, *Banksia hookeri*, now treated as *Banksia solandri* R. Br., and *Hakea victoria* were published in *Companion to the botanical magazine*, *Pterostylis rupestris* and *Hovea*

Table VI
Binomials in extracts of James Drummond's letters published in the various journals edited by W. J. Hooker*

Drummond's name	Place of publication	Date	Current taxonomic status, as cited
Melaleuca amara	*J. Bot.* (*Hooker*) 2: 361	1840	Never considered to our knowledge
Hovea grandiflora	*J. Bot.* (*Hooker*) 2: 365	1840	= *Hovea trisperma* Benth. (Ross 1989)
Pterostylis rupestris	*J. Bot.* (*Hooker*) 2: 367	1840	Never considered to our knowledge
Leschenaultia sanguinea	*J. Bot.* (*Hooker*) 2: 369	1840	Never considered to our knowledge
Comesperma scoparia	*J. Bot.* (*Hooker*) 2: 369	1840	*Comesperma scoparium* J. L. Drummond (Thompson 1978; Stove 1986); still cited in Western Australian literature (e.g. Green 1985) as *C. scoparia* Steetz (1848), a later name based on a Drummond specimen
my *Diplophragma spiralis*	*J. Bot.* (*Hooker*) 4: 81	1842	Never considered to our knowledge
Loudonia flavescens	*London J. Bot.* 1: 396	1842	*Glischrocaryon flavescens* (Drumm. ex Hook.) Orchard
Drakaea livida	*London J. Bot.* 1: 628	1842	Being taken up by M. Clements, in press (S. D. Hopper, pers. comm. 1989)
Drakaea lucida	*London J. Bot.* 1: 628	1842	Being taken up by M. Clements, in press (S. D. Hopper, pers. comm. 1989)
Dasypogon hookeri	*London J. Bot.* 2: 169	1843	*Dasypogon hookeri*
Boronia molloyi	*London J. Bot.* 2: 170	1843	*Boronia molloyae*
Dryandra floribunda	*London J. Bot.* 3: 308	1844	= *Dryandra floribunda* R. Br.
Dryandra quercifolia	*London J. Bot.* 3: 313	1844	*Dryandra quercifolia* Meisner, a later name based on a Drummond specimen
Huttia quadriflora . . .if new	*London J. Bot.* 3: 314	1844	Never considered to our knowledge (a legume; non *Huttia* J. L. Drumm. in Harvey 1855, nec Preiss)
Banksia hookeri	*Bot. Mag.* 74, *Comp.* 1	1848	*Banksia hookeri* J. L. Drumm., *nomen nudum*, = *B. solandri* R. Br., according to George (1981). '*Nomen nudum*' is incorrect; there is a more than adequate description of the plant, nor was George correct in indicating that it was cited as a synonym of *B. solandri* in the protologue.
Hakea victoria	*Bot. Mag.* 74, *Comp.* 2	1848	*H. victoria* Drumm.
Gastrolobium leakeanum	*Hooker's J. Bot. & Kew Gard. Misc.* 1: 247	1849	Never considered to our knowledge
Banksia floribunda . . .	*Hooker's J. Bot. & Kew Gard. Misc.* 1: 375	1849	*nomen dubium*: = *Banksia occidentalis* R. Br. or *B. littoralis* R. Br. var. *seminuda* A. S. George (George 1981a)
Stylidium elegans	*Hooker's J. Bot.& Kew Gard. Misc.* 1: 376	1849	Never considered to our knowledge
Acacia neilii . . . if new	*Hooker's J. Bot. & Kew Gard. Misc.* 1: 377	1849	Never considered to our knowledge
Verticordia grandis	*Hooker's J. Bot. & Kew Gard. Misc.* 5: 119	1853	*Verticordia grandis* Drummond; in Western Australian census (Green 1985) incorrectly cited as *V. grandis* Drumm. ex Meisn., *J. Linn. Soc. Bot.* 1: 42 (1857)
my *Lawrencella lanceolata*	*Hooker's J. Bot. & Kew Gard. Misc.* 5: 312; 5: 402	1853	[? = *Helichrysum* sp. as *Lawrencella* Lindley is a synonym of that genus]
Templetonia regina	*Hooker's J. Bot. & Kew Gard. Misc.* 5: 312	1853	= *Brachysema aphyllum* Hook. (Ross 1982)
Diuris picta	*Hooker's J. Bot. & Kew Gard. Misc.* 5: 347	1853	Being taken up by M. Clements, in press (S. D. Hopper, pers. comm. 1989)

* Because they appear in letters published under Drummond's authorship, the author of the names should be Drummond alone. All but one are accompanied by descriptions of sufficient diagnostic detail to qualify them as validly published names under the botanical code. Drummond's description of *Dryandra quercifolia*, 'A *Dryandra* with the foliage very similar to the *Luccombe Oak* might be appropriately called *D. quercifolia*' seems also adequate for valid publication of his name; it is known commonly today as the oak-leaved dryandra. In two cases, *Huttia quadriflora* and *Acacia neilii*, Drummond's names were provisional only.

grandiflora in Hooker's *Journal of botany and Kew Gardens miscellany*, and *Dasypogon hookeri* and *Boronia molloyi* (now altered to *B. molloyae*) in Hooker's *London journal of botany*. Other names to appear in his published letters are given in Table VI. Some of these have never been taken up despite their often more than adequate description.

Drummond sought to dedicate the black kangaroo paw, discovered by his son Johnston (Erickson 1969), in memory of his friend Mrs Georgiana Molloy who also collected specimens and seeds for British interests (Moyal 1986). He wrote to the editor of the Perth newspaper *The Inquirer* in June 1843 describing the plant and stating that 'Anigozanthus Molloyiae is a most remarkable plant and it may be said to be a true mourning flower' (Erickson 1969, p. 86). Unfortunately this letter was never published and the species was officially described in 1847 by Hooker as *Anigozanthos fuliginosus*. Later Drummond gave it a new generic name *Macropidia*, published by W. H. Harvey (1855b) with acknowledgement to Drummond, in Hooker's *Journal of botany*.

In fact a series of genera and species were attributed to Drummond by W. H. Harvey in this paper (Table VII). Harvey (1855a: his italics) wrote:

> I send you by post a paper by Drummond, on the Botany of the Northern Districts of the Swan River Colony . . ., and characters of certain new genera, which he requested me to examine and describe. The poor man feels rather sore that so many new genera should *first* have appeared in Preiss's book, which had been sent home by him (Drummond) years before Preiss visited the Colony; so I am anxious to preserve for him any little gleanings that may remain. The most curious of the genera described by me are the *Rutaceous*; and what I have called *Dicrastylis*, which appears to me to be either a *Cordiacea* with opposite leaves, or the type of a new Order, between *Cordiaceae* and *Verbenaceae*. I suppose you will find specimens of all in your last set of Drummond's plants. I hope you will allow *Drummondita* to stand, as D. feels rather uncomfortable in their being no *universally acknowledged* genus bearing his and his brother's name. He himself selected and proposed this plant for a '*Drummondia*; but with your genus of Mosses staring me in the face, I had to alter the name.

Apart from *Drummondita* the authorship of which is attributed solely to Harvey, even though it was Drummond who distinguished it and selected the type, the several genera involved are all attributed to 'Drummond ex Harvey'.

There is no doubt that Drummond contributed substantially to the erection of new species and genera in publications emanating from Kew. It is unknown to us the extent to which Drummond's duplicated sets of specimens, sold to others, were supplemented by informative notes such as were received by W. J. Hooker. However, none of the Drummond specimens we have seen from many herbaria bear anything in his hand other than his collection number.

As a result of this *ad hoc* method of publication of botanical results, Drummond probably missed out upon gaining credit for at least some of the new species

Table VII

Binomials attributed to James Drummond by William Harvey in a paper published in 1855 in *Hooker's J. Bot. Kew Gard. Misc.* (Harvey 1855b) with current taxonomic status*

Drummond's name, as published	Current taxonomic status (from Green 1985, unless otherwise stated)
Huttia J. Drummond	*Hibbertia* Andrews[1]
Huttia conspicua J. Drummond	*Hibbertia conspicua* (J. Drummond ex Harvey) Gilg
Hemistephus J. Drummond	*Hibbertia* Andrews
Hemistephus linearis J. Drummond	? *Hibbertia spicata* F. Muell.; non *H. linearis* R. Br.ex DC. (1817)
Geococcus J. Drummond	*Geococcus* J. Drummond ex Harvey (Hewson 1982)
Geococcus pusillus J. Drummond	*G. pusillus* J. Drummond ex Harvey (Hewson 1982)
Calopetalon J. Drummond	*Billardiera* (Bennett 1972)
Calopetalon ringens J. Drummond	*B. ringens* (J. Drummond ex Harvey) E. M. Bennett (Bennett 1972)
Drummondita Harv.	*Drummondita* Harv.
Drummondita ericoides Harv.	*Drummondita ericoides* Harv.
Sandfordia J. Drummond	*Geleznowia* Turcz.
Sandfordia calycina J. Drummond	*G. verrucosa* Turcz.
Symphyopetalon J. Drummond	*Nematolepis* Turcz.
Symphyopetalon corraeoides J. Drummond	*N. phebalioides* Turcz.
Urocarpus J. Drummond	*Urocarpus* J. Drummond ex Harvey
Urocarpus phebalioides J. Drummond	*U. phebalioides* J. Drummond ex Harvey
Platyptelea J. Drummond	*Aphanopetalum* Endl.
Platyptelea clematidea J. Drummond	*A. clematideum* (J. Drummond & Harvey) Gardner
Cheynia J. Drummond	*Balaustion* Hook.
Cheynia pulchella J. Drummond	*B. pulcherrimum* Hook.
Dicrastylis J. Drummond	*Dicrastylis* J. Drummond ex Harvey (Munir 1978)
Dicrastylis fulva J. Drummond	*D. fulva* J. Drummond ex Harvey (Munir 1978)
Dicrastylis reticulata J. Drummond	*D. reticulata* J. Drummond ex Harvey (Munir 1978)
Dicrastylis stoechas J. Drummond	*D. corymbosa* (Endl.) Munir (Munir 1978)
Macropidia J. Drummond	*Macropidia* J. Drummond ex Harvey (Hopper 1987)
Macropidia fumosa J. Drummond	*M. fuliginosum* (Hook.) Druce (Hopper 1987)
Xanthorrhoea drummondii Harv.	*X. drummondii* Harv. (Bedford 1986)
Lepilaena J. Drummond	*Lepilaena* J. Drummond ex Harvey
Lepilaena australis J. Drummond	*L. australis* J. Drummond ex Harvey

* Apart from the name the protologue of each taxon is by Harvey. Therefore, under the present *Code*, the author citation should be *J. Drummond ex Harvey*. However, the current methods of author citation give no credit to the fact that Drummond recognized the plants he named as distinct and that he provided Harvey with diagnostic characters (his 'characters': cf. quote from Harvey 1855a) for each taxon.

[1]*Huttia* Preiss ex Hook. is different from Drummond's genus of that name. It is a *Calectasia*.

Table VIII

Binomials in extracts of James Drummond's letters which were published in the various journals edited by W. J. Hooker and with authorship attributed to botanists other than the publishing authors*

Names, grouped under authors as published in Drummond's letters	Place of publication	Date	Current taxonomic status, authorship as cited
William Baxter			
Dryandra senecifolia	*J. Bot.* (*Hooker*) 4: 85	1842	*D. senecifolia* R. Br.
Dryandra squarrosa	J. Bot. (*Hooker*) 4: 85	1842	*D. squarrosa* R. Br.
Banksia brownii	*Hooker's J. Bot. Kew Gard. Misc.* 1: 375	1849	*B. brownii* R. Br.
Charles Fraser			
Xylomela occidentale	*J. Bot.* (*Hooker*) 2: 347	1840	*X. occidentale* R. Br.
Anigozanthus latifolia	*J. Bot.* (*Hooker*) 2: 348; *London J. Bot.* 1: 628	1840 1842	Never used to our knowledge
Hakea cristata	*J. Bot.* (*Hooker*) 2: 355	1840	*H. cristata* R. Br.
Petrophila linearis	*J. Bot.* (*Hooker*) 2: 355	1840	*P. linearis* R. Br.
Diplophragma bipinnata	*J. Bot.* (*Hooker*) 4: 81	1842	*Dryandra bipinnatifida* R. Br.
Dryandra bipinnata	*J. Bot.* (*Hooker*) 4: 85 *London J. Bot.* 1: 629	1842 1842	? *D. bipinnatifida* R. Br.
Banksia grandis London	*J. Bot.* 1: 87	1842	*B. grandis* Willd.[1]
Allan Cunningham			
Xylomelon salicifolia	*J. Bot.* (*Hooker*) 4: 80	1842	*Xylomelum salicinum* A .Cunn. MSS in Brown (1830)
Baron von Huegel			
Kennedya arenaria	*J. Bot.* (*Hooker*) 2: 357	1840	*K. arenaria* Endl., *Enum. Pl. Huegel* (1837) 38
Hibiscus hakeaefolius	*J. Bot.* (*Hooker*) 2: 361	1840	*H. hakeaefolius* Giord.
Eucalyptus occidentalis	*London J. Bot.* 2: 180	1843	*E. occidentalis* Endl., *Enum. pl. Huegel* (1837) 49
Ranunculus coloneus	*London J. Bot.* 2: 182	1843	*R. colonorum* Endl., *Enum. Pl. Huegel* (1837) 1
Ludwig Preiss			
Anigozanthos moorii	*London J. Bot.* 1: 628	1842	*A. bicolor* Endl. (1846) (S.D. Hopper, pers. comm. 1989). The description of *A. moorii* Preiss ex J. L. Drummond is more than adequate and this would predate *A. bicolor*. Bentham (1873) mentions an anonymous collection in Herb. Hooker collected in 1839 and annotated as *A. moorcana*, mihi.
Melaleuca leakei	*London J. Bot.* 2: 168	1843	*Nomen nudum*. A name never validly published (see p. 000)
Grevillea drummondii	*London J. Bot.* 3: 304	1844	At that stage not published; = *Grevillea tridentifera* Meisn. non *G. drummondii* Meissn. (1845)

* In most cases the protologue is based upon these botanists collections, but Drummond's citation raises at least the possibility that they provided the name in each case. In some cases it is possible that he was referring to the discoverer (initial collector) of the species rather than the person providing the name. Apart from Fraser, each of these botanists is known to have used his own informal binomials.

[1] *B. grandis* was also attributed by James Smith to Archibald Menzies, (q.v.).

he discovered and named. Even those which were published by Hooker have often been overlooked and are only now being recognized (Table VI). One example is *Comesperma scoparia* J. L. Drumm., which has been attributed to Joachim Steetz up to the present day (Green 1985).

Drummond attributed names to other collectors in south-western Australia, namely Fraser, already mentioned, Allan Cunningham, Ludwig Preiss, Baron von Huegel and William Baxter (Table VIII). This raises the question of whether these collectors might also have provided the names. Only Cunningham was given credit for the name cited by Drummond by the publishing author.

Ludwig Leichhardt (1813–1848)

He is something far superior to a mere Botanical Collector. (William Macarthur[14])

More usually thought of as an explorer than a botanist, Ludwig Leichhardt was born and educated in Germany. There is no doubt that Leichhardt was one of the most highly qualified scientists to come to Australia and it is sad that so much of the information he gathered has remained inaccessible until now in his unpublished diaries. Without doubt his contribution to science would have been substantial and wide-ranging had he not been so intent on exploration at the expense of publication and had he not died prematurely. A full account of his extensive preparatory studies in natural history and other subjects in Europe has recently been provided by Roderick (1988). A brief account of these is provided here.

During the years 1832 to 1837 Leichhardt studied a variety of subjects at Göttingen and Berlin Universities. At the latter he met the Englishman William Nicholson who was to support him financially for a number of years. After Nicholson completed his medical studies he returned to England, followed shortly after by Leichhardt who arrived there in May 1837. The pair embarked on a natural history tour of Somerset and Devon before moving to London where they spent the next 8 months studying the collections in the British Museum and the museum of the Royal College of Surgeons, their chief interest at this stage being comparative physiology. In June 1838 they crossed to Paris where they attended courses in natural history at Jardin des Plantes and the associated

Museum of Natural History as well as at the Sorbonne. In the discipline of botany, Leichhardt attended lectures and field work given by Adrien de Jussieu, the last of the great Jussieu dynasty (Stafleu 1971), but he also attended lectures in zoology, anthropology, geology, palaeobotany, ornithology, entomology and meteorology as well as some medical lectures and clinics. All of this was done with the express purpose of 'interpreting Nature' in Australia. With this in mind, during 1840 Leichhardt 'catalogued' the Australian and tropical flora in the Jardin des Plantes. While in Paris Leichhardt lodged in the same building as the botanist Gaetano Durando who was to become agent for the sale of his Australian collections.

Between September 1840 and June 1841, before embarking for Australia, Leichhardt and Nicholson engaged in a tour of France, Italy and Switzerland, with Leichhardt taking every opportunity to study geological features and items of natural history. At the end of this time Nicholson decided not to accompany Leichhardt to Australia but did continue to support him financially. Leichhardt was encouraged to send any undescribed specimens back to the museum in Paris. However, at this stage he hoped to come to some arrangement with William Hooker to whom Philip Webb had written a letter of introduction. His meeting with Hooker in September 1841 was totally discouraging. Hooker suggested New Zealand as a better place for a collector as he already had Drummond and Preiss in Australia. Besides there was very little new to be discovered there! Furthermore he did not approve of all-round naturalists, preferring to deal only with botanists. Nor did he offer any letters of introduction to his contacts in Australia.

This disinterest on Hooker's part in the highly educated student is almost certainly the reason why Leichhardt is not better known as a botanist. Had his notes and collections gone to Hooker at least some of Leichhardt's new taxa would have appeared in the journals which Hooker edited. Instead the collections mostly ended up in the herbaria at the Jardin des Plantes and at Sydney's botanic garden. From the latter they were later borrowed by Mueller (Maiden 1908b). However, by the time they were used by botanists such as Mueller, their importance had diminished by the accession of further collections from the regions Leichhardt had visited. We are uncertain of the sources of Leichhardt's collections examined by Bentham in the compilation of *Flora australiensis*. Prior to assembling his 'major botanical collections' from the Newcastle-Moreton Bay area, Leichhardt had sent specimens to Pamplin, a London dealer in natural history specimens who often acted as W. J. Hooker's agent (Roderick l.c., p. 236); some of these may have come to Kew. Others were amongst the many collections sent to Bentham by Mueller.

Leichhardt embarked for Australia in October 1841 having already informed his family that the 'interior, the unknown core of the continent, is my goal, and I will never give up until I reach it' (Roderick l.c., p. 155). He arrived at Port Jackson in February 1842. Although without an introduction from Hooker, he did have one to Sir Thomas Mitchell from Richard Owen, the well-known anatomist and palaeontologist. Mitchell invited Leichhardt to accompany him on his next prospective northern expedition, which was to eventually take place in 1846 (see later). In the meantime Leichhardt was offered a number of positions, which he declined. One vacancy which he was drawn to was that of superintendent of the Sydney botanic gardens (Gilbert 1986; Roderick l.c.). Despite strong representations by a section of the Sydney establishment, it was given to an elderly gardener.

In an account of his activities Leichhardt (1845) wrote to Durando on 6 January 1844 that he had

> quitted Sydney, after having devoted six months to studying the Botany of its environs, with the assistance of R. Brown's 'Prodromus' and the 7th Volume of De Candolle's great work. There were several tribes of plants, however, which I could not investigate: the Euphorbiaceae, for instance, because I had not the necessary books: among the other kinds, I made greater progress; and soon found myself competent to undertake some public herborizations, the first ever known in this colony, and to give a course of lectures on Botany, when I endeavoured to explain the structure of the different families of plants, and especially to direct the attention of the inhabitants, during their walks to the more common and prevalent species, particularly Myrtaceae, Rutaceae, Proteaceae, Epacrideae, and Cycadeae.

Leichhardt then carried out extensive field studies between September 1842 and April 1844 in the area between Newcastle and Moreton Bay. During this time he made the acquaintance of many of the land holders who were later to become his sponsors. As a result of his studies he was able to write to Durando on 12 July 1844 (Leichhardt 1845):

> I have sent a collection of plants to the museum of the Jardin des Plantes, which I hope may give satisfaction; but let it not be forgotten that these specimens were gathered in a country where I was in frequent risk of my life, and where every energy was required to enable me to travel, and partially to endure, fatigue, hunger, and thirst! I was compelled to cut down wood for firing, with my own hands, and to cook my food, while I was also a geologist and botanist, and to wash my own linen and dry my specimens, often passing ten days and a fortnight in the forests, without any companion but my horse and my dog. If I had not occasionally been assisted by friendly and hospitable individuals, I must have been compelled to relinquish my journey, and to discontinue my collections.

In August 1844 Leichhardt set out on his successful journey from Moreton Bay to Port Essington (Jackes, this volume). The journey completed in December 1845, Leichhardt returned to Sydney to prepare his account of it before setting out on his next expedition. The published narrative (Leichhardt 1847), edited by Phillip Parker King, contains numerous observations on natural history, particularly plants. To cite just a few examples, on 19 October 1844:

> On a botanical excursion I found a new Loranthus, with flat linear leaves, on Casuarina, a new species of Scaevola, Buttneria, and three species of Solanum;

on 13 January 1845:

> I observed a new species of Flindersia, a small tree about thirty feet high, with thin foliage and very regular branches, forming a spire;

and on 19 March 1845:

> On the plains I found two new species of Sida; and, on tea-trees, a new form of Loranthus, with flowers in threes

> on a broad leafy bract, scarcely distinguishable from the real leaves.

No effort was made to provide a binomial except in two cases, the first on 22 October 1844:

> On the banks of Hodgson's Creek, grows a species of Dampiera with many blue flowers, which deserves the name of 'D. floribunda;

and the second on 25 November 1844 when he commented on:

> a new species of forest oak, which deserves the name of Casuarina *villosa*, for its bark looks quite villous.

Neither of these names has ever formally been applied to these plants. Perhaps these specimens were amongst those destroyed by Leichhardt, as described in this extract of his hardships in a further letter to Durando (Leichhardt 1846):

> But you must bear in mind, my good friend, that it was not my lot to travel all at my ease, with every convenience at hand, and enabled to devote my whole attention to Natural History. On the contrary, I was compelled to do everything; I was alike leader of the party and bullock driver, and I had to load and unload three beasts of burthen, often several times in the day. All the cares of such a position were laid upon me; mine were the anxieties during the hour of difficulty and peril. To arrange our camp, deal out provision, kill the bullocks, and mend the harness, to compile the log and day-book of our route, to determine the latitude and longitude, and to keep nightly watch, all these various and ever-recurring occupations devolved upon me. Thus, even allowing that I did my very best, it is undeniable that a man, whose attention was less divided, could have effected infinitely more in any one department than I did. Gladly would I have made drawings of my plants, and noted fully all particulars of the different species which I saw; and how valuable would such memoranda have been, when the time arrived which compelled me to cut open all my fine cases so carefully formed, made of hides, and to make a scanty selection from their contents, throwing the greater part away, through the utter impossibility of carrying them on, four of my pack-horses having been drowned. Botanical and geological specimens thus abandoned — how disappointing! From four to five thousand plants were thus sacrificed.

Leichhardt's attempt to cross Australia from east to west began in October 1846 with a completely different party from that which had made the successful crossing to Port Essington. This expedition was intended to be 'a famous one for botany' (Leichhardt 1846), but in the event became bogged down by rain, mud, sickness and the constant need for the party of just nine men to care for and drove the incredible array[15] of livestock which accompanied them. The extent of Leichhardt's botanical collections from this journey is not known to us although Webster (1980, p. 104, 113) makes several references to collections by both Leichhardt and Daniel Bunce, predominantly in the early days of the expedition. The expedition was aborted in July 1847 after nine months of misery.

In March 1848 Leichhardt with six or seven new party members and less livestock[16] commenced his second attempt at an east-west crossing of Australia. Neither he nor his party were ever seen again. With his disappearance went any hope that he could 'sit down with his books and specimens and catch up on his six or eight years of wandering and collecting' as he had written to Durando (Roderick l.c., p.453). It also prevented him from vindicating the support of many of his contemporaries, including William Macarthur of Camden (see introductory quotation).

Despite probably being one of the most competent botanists of his time in Australia, Leichhardt's expertise was lost to science. His failure to publish, the loss of many of his collections, and the fact that his surviving collections went to Paris and Sydney rather than to Hooker all contributed to this. Notwithstanding Hooker's unsympathetic response to his representations, there may well have been numerous names attributable to Leichhardt today had he been offered the job at the Sydney botanic gardens or joined Mitchell's fourth expedition as naturalist. Instead, as far as we can establish, only one of his names has been published: *Tribulus minutus* Leichhardt ex Benth. (Dr Hj. Eichler, pers. comm. 1989). One of his manuscript names can be seen on a specimen of *Sida* in the National Herbarium of Victoria (MEL 53496) collected from Collyblue Mount on 29 March 1843 and there are no doubt others to be found.

Sir Thomas Livingston Mitchell (1792–1855)

A man of great ambition was the Surveyor-General of New South Wales Major Thomas Livingston Mitchell (Cumpston 1954; Foster 1985). In his time, despite disagreements with his superiors, he was feted by the public and in 1839 gained the knighthood he sought. Today he is perhaps commemorated by more monuments than any other Australian explorer. His quest for recognition above that of his contemporaries and predecessors coloured his documentation of his travels. It has even been suggested (Carter 1987) that he renamed features of the landscape when they had been already named by others.

Mitchell organized and participated in four expeditions while in office. His accounts of the first three were published in the two-volume work *Three expeditions to the interior of Australia* (Mitchell 1838, 1839a,b). Prior to leaving for Australia in 1827, Mitchell was often in the company of the geologist Fitton and Robert Brown (Foster l.c., p. 107), from whom he no doubt received encouragement to collect natural history specimens. To ensure the accurate scientific documentation of each expedition he gave the associated collections to leading scientists in Britain while on his visit there in 1837–1838 to arrange publication of the work (Mitchell l.c., preface; Foster l.c.; correspondence[17]). John Lindley, Professor of Botany at the University of London received the rich botanical collections.

Mitchell appears to have collected little of botanical interest on his first expedition to northern New South Wales in 1831–1832. Few plants were reported in the account, and Mitchell does not appear to have appointed a collector. On 13 January 1835 he observed one striking tree, apparently *Owenia acidula*, of which he drew a fruiting branch. Despite its foliage and fruit and its use to the Aborigines being described at some length, the tree is unnamed in the text, indicating that no collection was available to Lindley. In his diary and published journal entries of 17 August 1835, he expressed his regret at not collecting *Capparis mitchellii* during this first expedition. Only two species

were described as new by Lindley, *Calostemma candidum* and *Hibiscus tridactylites* (see table in appendix).

The second expedition in 1835 saw Mitchell appoint an experienced botanist Richard Cunningham, brother of Allan, but he was again fated to produce limited botanical results. Early in the expedition Cunningham became separated from the party, lost his horse and wandered for some days, and was at length killed by Aborigines. No collections made by Cunningham were utilized in the journal; whether any survived is unknown to us. On 13 April, four days prior to his disappearance, 'Mr. Cunningham had a busy day in examining many interesting plants' (Mitchell 1835a,b, 1838, 1839a,b). Seven species were described as new on the expedition, all based upon observations and collections referred to in the journals after Cunningham's death. They were *Panicum laevinode*, *Trigonella suavissima*, *Atriplex halimoides*, *Danthonia lappacea*, *Capparis mitchellii*, *Cassia teretifolia* and *Elensine marginata*. There is again no indication as to whether anyone assisted Mitchell in collecting these plants. Mitchell's diary in the Mitchell Library shows him to have been not disinterested in the flora. He was conversant with the more common and distinctive genera such as *Casuarina*, the 'pines' or 'cypresses' (*Callitris*), and *Acacia pendula*. He speculated on the use by the Aborigines of the heaps of *Panicum laevinode* 'which extended for miles', and commented at length on *Trigonella suavissima* (1 July: Mitchell 1835a, 1838, 1839a,b):

> the same fragrant trefoil I had seen on the 4th June . . . The perfume of this herb — its freshness and flavour endeared me to try it as a vegetable, and we found it delicious, tender as spinach — and beautifully green when cooked . . . I endeavoured to preserve some of its roots by taking them up in the soil, as the seed (a very small pea) was not ripe.

Mitchell made great efforts to find seed of *Capparis mitchellii*, its fleshy fruit a favourite with the natives. He wrote several times of it in his diary, for example on 18 August 1835:

> This morning as we proceeded I was more successful in my search for seeds of the fruit above mentioned — I was surprised to find many of the trees in the scrub through which we had previously passed without my having observed them there. On one we found some full grown fruit not ripe and on others perfect specimens of last season's fruit including, of course, the seeds — the fruit resembles a small lemon, inside are small nuts or stones . . . in a soft mucilaginous pulp of a pleasing flavour and agreeable perfume — We also found some specimens of the flowers but rather faded.

The final two expeditions were considerably more successful botanically. He again appointed experienced botanists. On his 1836 expedition during which he discovered his luxuriant 'Australia Felix' encompassing the Grampians and surrounding lowlands of western Victoria, he chose the conviet John Richardson as 'Collector of Plants' (see later section). Many plants were collected, among them 68 which were described as new by Lindley. Richardson was mentioned specifically only four times in Mitchell's diary, never by name but each time as 'collector': on 17 April 1836 'found several new plants, especially an [Orculis] which was new to the collector', (square brackets his, name added later), on 19 April, on 20 April, and on 23 July on climbing Mt Arapiles ('Mt Last of All' in his diary):

> On its sides grew cypresses — casuarinae, and a variety of shrubs — twelve of which were new to our collector of plants besides three others found about the lakes.

In each instance in the published journal the word 'collector' was replaced by an ambiguous 'we' or similar, so that Richardson's ordained role is mentioned only in the list of personnel on the expedition.

We may never know to what extent each man was involved in the botany of the 1836 expedition, although one suspects that Richardson played the major role. Examination of Lindley's herbarium and any associated papers at Cambridge University may shed light on this. However, it is likely that Richardson supplied Mitchell with many of the names, sometimes incorrect, used in the text, for example *Cupressus australis* (for a *Callitris*) and the two *Acacia* names in this entry in his diary: 'In a strip of scrub consisting of Acacia longifolia — lanceolata and some graceful shrubs . . .'. Nevertheless, Mitchell does demonstrate in his diary an enthusiasm for plants similar to that shown in his previous expeditions. Among the plants he referred to (see table in appendix), he noted his collecting bulbs of *Calostemma carneum* and seeds and flowers of the strange *Gyrostemon pungens*, drew an unnamed *Ranunculus*, and presented crude ideas on the adaptation of the habit to fire of *Eucalyptus dumosa* and 'a prickly bush' (?*Triodia*). Seeds of *Roepera aurantiaca*, *Psoralea cinerea*, and *Picris barbarorum* and bulbs of *Bulbine suavis* were later cultivated in the Chiswick Gardens of the Royal Horticultural Society. The *Bulbine* flowered in May 1838, the *Roepera* in July. The cultivated specimens of the former formed the basis of the description in the *Three expeditions* published shortly after.

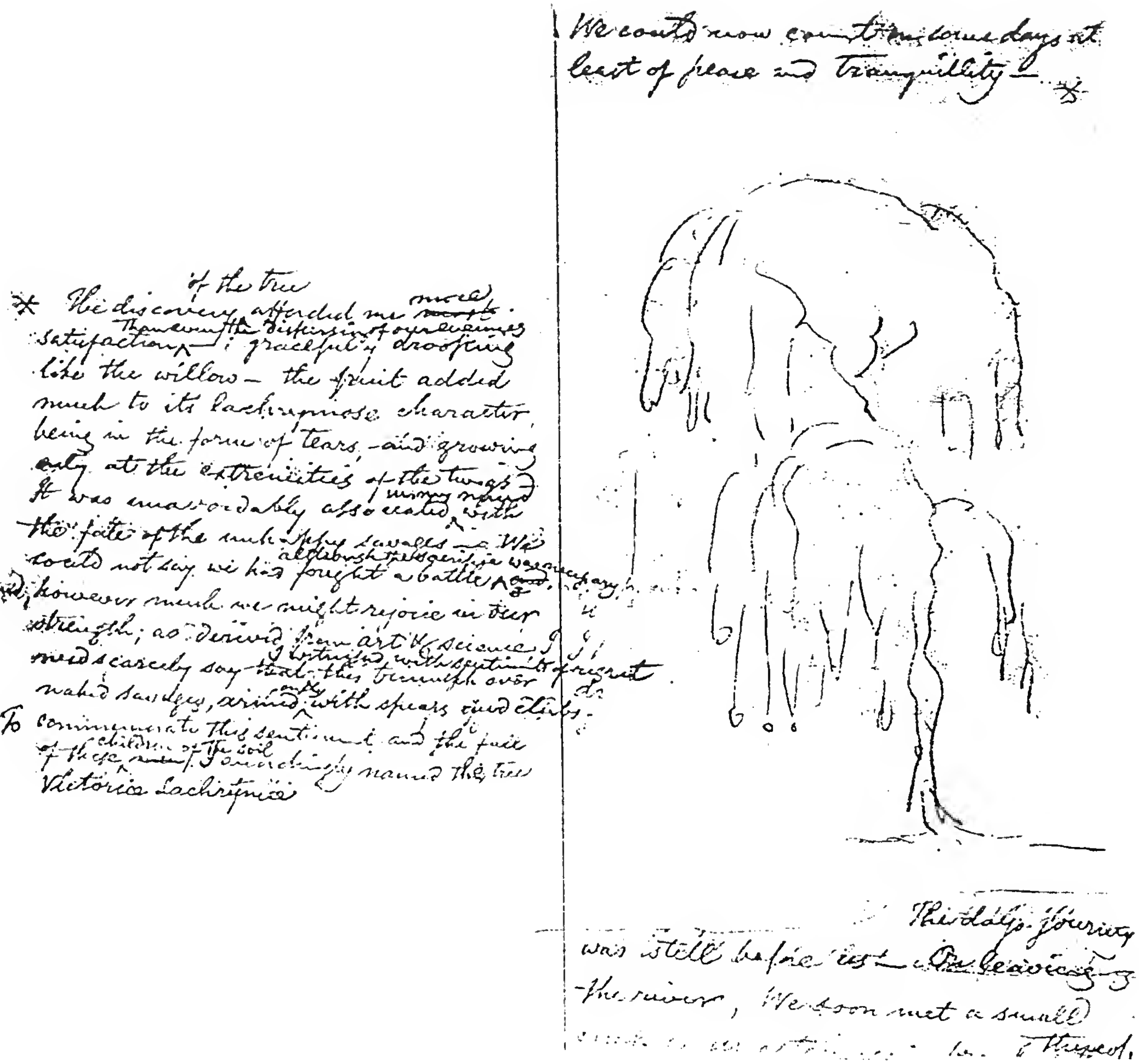
In only four instances was Mitchell involved in the naming of new plants. Of *Pelargonium rodneyanum*, Mitchell (1838, 1839a,b) wrote:

> We also discovered a beautiful new species of the Cape genus *Pelargonium*, which would be an acquisition at our gardens. I named it *P. Rodneyanum* [and added in the second edition] in honour of Mrs. Riddell at Sydney, grand-daughter of the famous Rodney.

None of this appeared in his diary entry of 21 June 1836. Similarly, none of the lengthy description of the plant Mitchell provisionally named *Cassia heteroloba*, if new, appeared in his diary. It is possible that this occurred in a separate field book, possibly assembled by Richardson or with his help.

In the third instance Mitchell named and described a new genus and species, apparently independently (Fig. 3). It was the false sandalwood, a plant of great significance to him. Mitchell saw this small tree several times on the plains about the River Murray. A stand was observed on the day his party was attacked by Aborigines.[18] Mitchell chose to give the plant a new name (Mitchell's 1836 diary, Mitchell Library; Fig. 3):

> The discovery of the tree afforded me more satisfaction than even the dispersion of our enemies — gracefully drooping like the willow — the fruit added much to its lachrymose character being in the form of tears, and



We could now count on some days at least of peace and tranquillity — *

* The discovery of the tree afforded me more satisfaction [illegible] ; gracefully drooping like the willow — the fruit added much to its lachrymose character, being in the form of tears, and growing only at the extremities of the twigs. It was unavoidably associated with [illegible] the fate of the unhappy savages — We could not say we had fought a battle, [illegible] and, however much we might rejoice in our strength, as derived from art & science, I need scarcely say that this triumph over naked savages, armed only with spears and clubs [illegible]. To commemorate this sentiment and the fate of these children of the soil I accordingly named the tree Victoria Lachrymosa

This day's journey was still before us — On leaving the river, We soon met a small [illegible]

Eucarya Murrayana (mihi).

Fig. 3. a—The extract from Mitchell's diary entry of 27 May 1836, in which he sketched the habit of the false sandalwood and arrived at the name 'Victoria lachrymia' for it. The name commemorated his future Queen and expressed his remorse at the death of Aborigines at the hands of his men on that same day. The fruit illustrated in the publication was sketched on another page of the diary. (Mitchell 1836, from microfilm frame 50A, courtesy of the Mitchell Library). **b**—The published engraving of the plant in his *Three expeditions . . .* (Mitchell 1838).

growing only at the extremities of the twigs — It was unavoidably associated ... with the fate of the unhappy savages. We could not say we had fought a battle although the sacrifice was necessary and, however much we might rejoice in our strength as derived from art & science I need scarcely say that I witnessed with sentiments of regret this triumph over naked savagery, armed only with spears and clubs. To commemorate this sentiment and the fall of these children of the soil I accordingly named the tree Victoria lachrymia.

In his published account Mitchell (1838, 1839a,b) changed his choice of 'Victoria lachrymia' for the tree, for soon after his arrival in London in July 1837 to finalize his publication Lindley had published on *Victoria regia*[19] which he had named after the newly crowned Queen. A series of changes to names appearing in Mitchell's diaries may have resulted directly from this. The Rodney Range became the Victoria Range, which in turn may have led to the naming of *Pelargonium rodneyanum*. The second edition saw Mitchell even reapply his epithet 'lachrymia'. An illustration, presumably his, of an unnamed tree ends the account of the 1835 expedition in the first edition. In the second edition, despite no reference to the tree occurring in the text, the name *Eucalyptus lachrymosa* has been added, presumably by Mitchell (see table in appendix, note b).

To completely alter his new tree's name by removing reference both to Victoria and to the clash with the Aborigines was surely politic: it may have seemed expedient at the time to associate a Princess with tearful remorse for the consequences of sacrifices for the realm, but, with his prospects for knighthood diminished by his handling of the conflict at Mt Dispersion (Foster 1985) and the Princess now a monarch, it would not have been very tactful for one seeking the highest rewards from his country. His published name *Eucarya murrayana* represents the establishment of a new genus as well as a new species (but see note 'm' in the appendix). The generic name referred presumably to the fruit's well-developed nut (Black 1948), while he commemorated in the species epithet his major patron (Foster 1985), Sir George Murray, the Colonial Secretary in London in 1828–1830.

Some botanists in the past have considered that Mitchell's publication of *Eucarya murrayana* was inadequate at least in relation to the genus *Eucarya* (Sprague & Summerhayes 1927; Pilger 1935; J. J. Swart in Farr *et al.* 1979). Those who have accepted the generic name as published in the *Three expeditions* are surely correct (e.g. Gardner 1929; Black 1948; Airy Shaw 1973; George 1984). Not only did he provide a full botanical name, which unlike all other such names in his published journal he attributed to himself ('mihi'), but Mitchell also gave a brief description, which included a diagnostic statement comparing it to the quandang (*Fusanus acuminatus*, now *Santalum acuminatum*), and provided a relatively accurate illustration of the habit of the tree, its foliage and fruit (taken from his sketches in his diary). He clearly intended to publish the name. Nevertheless, in view of the comparisons with the quandang, it is likely that Mitchell sought advice on the status of his plant from a botanist, probably Lindley with whom he had much correspondence prior to publishing *Three expeditions*.[20]

Often referred to in the expedition accounts was the quandang. Amongst the frequent correspondence which Mitchell received from Lindley about his plants, Lindley[21] indicated his intention to describe it as a new genus:

Quandang must be named after its discoverer — & I think I have hit upon a way of getting over the difficulty of there being already the names of Mitchella & Michelia in Botany. Let me make a Mitchellaria. Why not? It's all en règle.

Lindley's genus never eventuated. On 27 November 1837 Lindley wrote that Mitchell had mixed the flowers of a mistletoe ('Loranthus') with the fruiting branches of the quandang in his collections.[22] The quandang had been described much earlier by Robert Brown (1810b) as *Fusanus acuminatus*. The insertion of Brown's *Fusanus acuminatus* in Mitchell's 'Systematical list of the new plants ...' may relate to this misidentification, although Lindley had corrected the error at a very early stage.

Mitchell's fourth and last expedition into inland subtropical Queensland took place between November 1845 and January 1847. His botanist was William Stephenson, 'Surgeon and Collector of objects of Natural History'. Botany is again prominent in the published account of the expedition *Journal of an expedition into the interior of tropical Australia in search of a route from Sydney to the Gulf of Carpentaria* (Mitchell 1848).

Unlike the effective anonymity with which Richardson, and doubtless others, were rewarded, credit is given often to collectors, sometimes by name in this journal. Thus, Mitchell prefaced a long list of plants, which included 16 new species, with (p. 359):

Mr. Drysdale, the storekeeper, had collected an herbarium during the long sojourn of the party at that camp, which included many new plants.

On 31 August 'we found a plateau of flowering shrubs, chiefly new and strange, so that Mr. Stephenson was soon loaded like a market gardener'. On 6 October, Stephenson and the party of men left back at camp were each credited with collecting listed sets of plants. On 10 October on Mt Faraday, 'Mr. Stephenson was with me, and found some new plants and insects, while I ascertained the height by barometer ...' while later that day, 'Many beautiful shrubs were now beginning to bloom ... Mr. Stephenson and I had been so busy collecting these on our way back, that we only reached the camp at sunset'. On 13 October 'On Mount Owen Mr. Stephenson found a new species of *Vigna* with yellow flowers [*V. lanceolata* Benth.] ...'.

Among the many plants collected were 141 described as new species. Lindley arranged to divide the collections between himself and three others (Foster 1985). Of the families with new species, apparently George Bentham dealt with the Leguminosae, Labiatae, and Myoporaceae, and Professor William Hendrick de Vriese of Leiden investigated the Goodeniaceae, while Lindley and W. J. Hooker of Kew worked up the remainder.

Mitchell again named a new genus of plants. *Delabechea* was a remarkable bottle-tree in the family Sterculiaceae (Fig. 4). On this occasion, however, Lindley described the genus and discussed its relation-

Fig. 4. Mitchell's curious *Delabechea*, now known as *Brachychiton rupestre*. From a drawing by his second in command Edmund Kennedy.

ships at length; it is today recognized as a section of *Brachychiton* (Guymer 1988). Mitchell named the plant 'after Sir Henry T. De la Beche, as president of a Society which has greatly encouraged him in his Australian researches . . .'. De la Beche was President of the Geological Society of London around that time (*Chambers encyclopaedia* 1896; *Encyclopaedia britannica* 1958).

It is evident that Mitchell had gradually learnt from his previous expeditions and the various botanists he met of the rewards to be reaped from making good collections. This last work shows an awareness of the value of making large collections from a particular region, enabling a description of the floristic composition of its different habitats, while at the same time encompassing any novelties which might occur.

William Swainson (1789–1855)

While the failure to publish their botanical findings has led to many of the collectors of Australian plants not being given justifiable recognition there is perhaps one case where the botanical community should be appreciative of the lack of publication. William Swainson, more usually a zoologist[23] than a botanist, was appointed by Lieutenant-Governor Latrobe in 1852 to report on the timber of the colony of Victoria, particularly the genera *Eucalyptus* and *Casuarina* (Galloway 1978). That report was tabled in November 1853 and within it Swainson claims to have discovered within Eucalyptidae 'five distinct and well-marked genera, hitherto unknown as such, and apparently peculiar to Victoria; together with two other new genera, which occur also in the adjacent province'. His grand total of species and varieties was 1520: 'even if two-thirds may hereafter prove varieties only, there will yet remain more than 500 species, botanically distinct, only two or three of which I have found in New South Wales' (Swainson 1853). Swainson had earlier claimed in a letter to the Colonial Secretary of New South Wales (reproduced in Galloway l.c.) that 'in the Illawarra district alone, generally considered very poor in 'Gum trees' I have already discovered and determined more than 50 species of which dissections etc. have been made'.

Of *Casuarina*, Swainson (l.c.) claimed that 'all the descriptions now existing were perfectly and essentially defective, and therefore quite useless'. He attached a list of all of the species he had found claiming that 'Of all those named in the list I possess elaborate descriptions, partly written with the trees before me'. In a note attached to the 213 species listed, he regretted that he had to leave some species unnamed, although described. The lack of any books to refer to had led to an exhaustion of all the specific names he could think of that might be appropriate!

Continuing, he declared: 'As there exists no scientific society or other medium for publishing an essay on these trees in Melbourne, I think the Royal Tasmanian Society (of which I am an honorary member) will gladly do so in their own transactions'.

Presumably the Royal Society of Tasmania was not appreciative of Swainson's efforts as this work was never published. W. J. Hooker reproduced the report in his *Journal of botany and Kew Garden miscellany* referring to it as a 'singular document' which is 'startling in some of its statements' (W. J. Hooker 1854). Privately he wrote to Mueller:

> I cannot say that I gave to our Secretary for the Colonies an equally flattering account of Mr Swainson on the Gum Trees!!! In my life I think I never read such a series of trash and nonsense. There is a man who left this country with the character of a first rate naturalist (though with many eccentricities) and of a very first-rate Natural History artist and he goes to Australia and takes up the subject of Botany, of which he is as ignorant as a goose.[24]

Maiden (1901) described Swainson's efforts as 'an exhibition of reckless species-making that, as far as I know stands unparalleled in the annals of botanical literature'.

III. Documentation of the Australian flora in Australia by Australians

A. Introduction

We have dealt above with selected examples of people collecting plants in Australia, recognizing novelties and sometimes supplying manuscript names for them. As we have seen, the specimens invariably found their way back to Europe, usually England, where those found or confirmed to be new were named by the celebrated botanists of the day, principally Robert Brown, John Lindley and W. J. Hooker. The extent to which manuscript names have been ignored is unclear, but in most cases acknowledgement of authorship of the collectors was a hit and miss affair. Thus, if Hooker chose to publish a letter within his journals and if the letter happened to contain a binomial with an adequate description, the name has the same nomenclatural standing today as any of Hooker's more formally treated novelties. There were numerous descriptions without accompanying binomials within Gunn and Drummond's letters, which, despite references to their novelty, have no taxonomic standing today.

The reasons for the dearth of publication by Australian residents are several. Among them were their

conditions of employment, little access to the botanical works of the day, lack of an authentically named Australian reference herbarium, and lack of an accessible means of publication.

Except for the establishment and maintenance of gardens and introduced crops, priority for employment of natural history specialists within the Australian colonies would have been low. Energies must have been channelled into activities which helped to make the small, isolated and struggling settlements self supporting. With the nucleus of educated people very small, the collection of natural history specimens by residents was mainly for financial gain. Most botanical collections ended up in gardens rather than herbaria. The collectors of herbarium specimens were supported from outside the colony or by other means. Baxter, Caley and Allan Cunningham were paid a wage from employers in England. Drummond supported himself to some extent by the sale to Europe of seeds and duplicated sets of dried specimens, but also farmed substantial acres, while Gunn and Backhouse had other occupations, but had sufficient means to have spare time to collect. Paterson and Mitchell were both government employees. Leichhardt was privately sponsored, but partly defrayed his costs by selling specimens.

There was no vehicle for publication of novelties within the colonies, except in local newspapers. One exception was Allan Cunningham's (1825) account of plants of the mountains behind Sydney, published in Barron Field's *Geographical memoirs of New South Wales*, but even this was published in London. Scientific societies did not really exist until the 1850s, although numerous attempts had been made to start them from as early as the 1820s (Hoare 1981; Moyal 1986). The bulk of the papers in Field's volume had been presented to the short-lived Philosophical Society of Australasia formed in 1821. The Society was so exclusive that Cunningham was not invited to join it (Finney 1984). It was wound up in 1822. In contrast, Gunn figured prominently in the Tasmanian Society (1838–1848) (Burns & Skemp 1961); he was its secretary from 1840 and the editor of its publication *The Tasmanian journal of natural science*.

In these early colonial times there were no accessible private or public botanical libraries or herbaria. Gunn and Drummond acquired personal copies of some literature from Hooker in exchange for their specimens. Those more botanically educated collectors built up their own private herbaria, supplemented by others they encouraged to collect for them, but very much regional in their scope. These collectors could not be sure that a plant new to them was new to science. When enquiring of W. J. Hooker whether *Melaleuca leakei* had been published by Ludwig Preiss, Drummond (1843, p. 168) commented:

> I send you a species of *Melaleuca*, named *M. leakei* by Mr Preiss, upon which Mr Leake particularly desires your opinion, as to whether it has hitherto been undescribed; since Mr Preiss's situation in this colony rendered it difficult for him to ascertain positively whether a plant was new, or has been discovered previously by British botanists.

The scientific standing of the early Australian resident botanists was accordingly such that they were reliant on members of the established scientific community in England. With the social attitudes of the day, no results of their collecting could be said to have been their own.

B. The Muellerian era of Australian systematic botany

> *Colonial experts, familiar with a distinctive environment and achieving a growing mastery over their own data, became anxious to put their knowledge to systematic and deductive use and were increasingly less willing to serve as the amanuenses of British science.* (Moyal 1986, p. 149).

Not until Ferdinand Mueller took over W. J. Hooker's influence over Australian botany were works published in Australia. His arrival on Australian shores, collecting before he even left the ship (Womersley & Sinkora 1987), coincided with the rising in consciousness of the Australian identity (Moyal 1986) and marked the birth of a new era in Australian systematic botany.

There have been several biographies of Mueller (Willis 1949; Kynaston 1981; also Willis and Short, this volume), and we need refer only to pertinent points of his life. Mueller shared many of the academic qualities seen in the tragically shortened scientific career of Ludwig Leichhardt. Mueller, too, botanized extensively in his first years in South Australia and Victoria, journeying on occasions for hundreds of miles on horseback. He participated in Augustus Gregory's North Australian Expedition from the Victoria River and Arnhem Land to Brisbane in 1855–1856 (Gregory & Gregory 1884; Birman 1979). Unlike Leichhardt, Mueller published the results of his explorations immediately on his return. He confined himself largely to botany. Accordingly, his activities were not spread so thinly as Leichhardt's who tried to encompass the entire natural world.

Mueller built up a massive herbarium, initially through his own collections. He encouraged much botanising by others, as a supporter of exploring expeditions or by contact with resident Australians in every state. By the exchange of material with botanists overseas he was able to build up a named world collection of plants. His exchange collections, which abound in the older overseas herbaria, enhanced studies by overseas botanists on Australian plants. Mueller also accumulated a large botanical library.

Mueller's output of publications was immense, ranging from checklists of collections from expeditions to monographs of *Eucalyptus*, *Acacia* and the Chenopodiaceae, and from two censuses of Australian plants to a Flora of Victoria. He began in 1850 with contributions to overseas journals (Churchill *et al.* 1978). Later he used Victorian parliamentary reports and journals such as *Chemist and druggist of Australasia*, which reflected his initial training in pharmacy. His ambition to produce a Flora of Australia saw the commencement of his (Mueller 1858–1882) large 12 volume, 92 fascicle series *Fragmenta phytographiae Australiae*, which included many new species, described as he received or collected material, and his changing concepts of various plant groups. However, Hooker wisely saw the need for a British-based Flora of Australia. The important material upon which the bulk of published Australian names were based was in

Europe, particularly at Kew and the British Museum. Although Mueller disagreed that the project needed to be carried out in Britain, he collaborated with the chosen author, George Bentham, by sending much of his herbarium with its accompanying annotations to London.

To a large extent Mueller took over the patronising role in the documentation of the Australian flora that British botanists, particularly Joseph Banks and then W. J. Hooker, had played before his arrival on the continent. Unlike most of his predecessors he used considerable first-hand field knowledge to form his own opinions about the plants. His publications on the Australian flora were largely without Australian collaborators. It was only very late in his long botanical life that he published with botanists in the other states, such as J. H. Maiden and Ralph Tate. The help he gained from British colleagues such as the Hookers, however, may have been underestimated. J. D. Hooker wrote repeatedly (Kynaston 1981, pp. 140, 152ff) of his problems comparing Mueller's difficult manuscripts and fragments with the large body of literature and herbarium material at Kew, pointing out to Mueller that:

> ... no one who has not worked in a great library and Herbarium, has any conception of the amount of labour and time lost in approaching completeness and accuracy in descriptive botany.

The former British mentors were thus demoted to answering his queries. J. D. Hooker wrote (Moyal 1986, p. 150):

> ... I observe that the consultation & reference to your fragments have cost Mr Black and myself more labour than the work of any other Botanist whatever.

C. Consolidation after Mueller

Mueller's death in 1896 after 50 years of dominance and productivity in Australian systematics left a void. Bentham's (1863–1878) *Flora australiensis* remained the definitive work on Australian plants for years. After such a 'critical general flora' comes a 'decentralization phase' (Jacobs 1972), with the production of regional floras. This period of Australian plant systematics warrants investigation for a separate review. The few botanists in each state were involved in floristic works (reviewed by George 1981b); floras were produced for South Australia, Tasmania, Northern Territory, Victoria and Queensland, and censuses for Western Australia and New South Wales. Mueller had produced some monographs and censuses, and a few resident botanists did likewise. Sydney was a centre of monographic work. Maiden (1903–1933) and Blakely (1934) effectively monographed *Eucalyptus*, Blakely (1922–1925) the Australian loranthoid mistletoes, and R. H. Anderson (1923) *Sclerolaena* (then known as *Bassia*). The orchids were the subject of special study by Nicholls, Rupp, Rogers and others.

One notable omission from the floristic accounts of the day was consideration of monographic work by continental European botanists (Hj. Eichler, pers. comm.; Barker 1982, p. 93). The reasons for ignoring the species described in revisions of *Euphrasia*, Stackhousiaceae, *Epilobium*, *Plantago* and *Blennodia* are not clear. At least the first two were based on material in continental European herbaria only, with no reference to the important holdings at Kew and the British Museum. Perhaps Australian botanists held the same views that Hooker had expressed to Mueller, that the sound treatment of the Australian flora required reference to these old British collections. The links which Mueller had established widely on the continent were presumably severed with his death. The remaining and coming botanists had the more traditional ethnic links with Britain. The reliance on their British counterparts for taxonomic judgements continued (e.g. a request concerning Santalaceae: Sprague and Summerhayes 1927). This was a time of distrust between nations which led to the two World Wars. Factionalism between national groups of plant taxonomists apparently developed over nomenclatural issues (see Britten 1904, and other papers in the *Journal of botany*). These factions resulted from the debates at the turn of the Century concerning changes to the 1867 Paris version of the *International code of botanical nomenclature*.

Since the 1950s, with the coordinated moves among Australian botanists for a new Flora of Australia (George 1981b), and particularly with the sudden burst of public and political awareness of conservation issues in the early 1970s, Australian plant systematics has entered a new vigorous and independent phase. Flora production on a regional, state and national basis and monographic work go on in tandem. The traditional links with British herbaria will always be maintained. So important are their collections that an Australian botanist is appointed to Kew annually to answer questions from his colleagues in Australia. Research is very much an international activity, however. Through the possibility of overseas visits, loans of specimens, and microfiche photographs of those herbaria that cannot be loaned, revisional study can now be undertaken in Australia without any of the shortcomings expressed by Hooker to Mueller.

IV. Plant collectors overstated and overlooked

> *It shows how credit is always given to the person who is the leader ... all others being thrown in the shade even if they happen to be more deserving.* (John Roper of Ludwig Leichhardt[25])

The previous sections have highlighted the role of many people in the naming of Australian plants. This section deals with a selection of the early plant collectors, some already mentioned. Seldom did Australia's early publicized plant collectors act on their own. Often their companions deserved as much credit for the collection. It has been noted already that Robert Brown's herbarium of Australian plants incorporated his assistant Peter Good's without any note to that effect (Edwards 1981; Clarkson 1988). In a similar way many of Ronald Gunn's collections were made by other people (see Buchanan 1988, this volume).

Government expeditions were run on military lines with a requirement that the leader keep a day-to-day record of observations and events and collect items of natural history. At the end of the journey all journals and curiosities collected by members of the expedition were to be turned over to the leader. Little wonder then that collections made were attributed to him. Even the officers were not always credited with their specimens.

All accolades went to the leader with his monopoly on publication. Publication of competing journals of the expedition by other members of the party would probably have been seen as a waste of time once the 'official' version had been published. Any conflicting comments made by the largely uneducated 'men' of the party would have been either seen as in bad taste by the establishment or ignored.

We perpetuate this lack of recognition of the actual collectors by assigning specimens to the leader of an expedition, rather than to his 'herbarium'. However, with the passage of time it is unlikely that we can establish the true gatherers of particular plants.

A. The Aborigines

The extent to which Aborigines played a role in guiding many collectors to plants needs investigation. Most explorers included Aborigines in their party, and they would no doubt have been important in the discovery of plants even in regions beyond their homeland. In his translation of Leichhardt's diary of his visit to the Bunya Bunya Mountains, Roderick (1988, p. 215) wrote of him:

> Nicky and another lad ... took him on botanical excursions, climbing trees to secure leaves and fruits, accompanied sometimes by an ancient whose native name was Burbello ... Forgotten men now, gone like the leaves of the forest; but eager and anxious then to please this tall friendly visitor from another world. 'With what slender means', he ruminated, 'can a naturalist in this neighbourhood achieve with the help of the blacks ... If I were sure of support I would spend a year here and live as much as possible with the blacks.'

In contrast Mitchell's party in Australia Felix was not on such good terms with the Aborigines. The second in command Stapylton wrote on 28 July 1836 about the loss of his faithful dog Smut, assumed to have been killed by an aborigine (Andrews 1986):

> I am confident he has been barburously murdered by one villain whom I could name in this party This is A little too bad but it is exactly what I expected would take place under such A system of toleration towards such wretches Black fellow shot at and wounded to day by one of the men in the Bush — Native shipped his spear and was accordingly very properly fired at now for war with these Gentry I suppose[.] they are encamped around us tonight tomorrow will give them A Benefit if they dont keep of — Piper [Mitchell's aboriginal interpreter] carries A Pair of Handcuffs slung round him as one must be taken Prisoner for the sake of obtaining native names of Places ...

B. Convicts, the often anonymous collectors

While we have already seen that the collection of natural history items was one of the few ways that convicts could benefit financially, it seems that convicts may well have been the real collectors on some of the early explorations.

Soon after his arrival at Port Jackson in 1817, Allan Cunningham trained a convict servant to collect plants (McMinn 1970). This anonymous person collected without Cunningham at Illawarra in 1826. Similarly, in 1824 Cunningham left instructions for other servants to make botanical journeys while he was absent at Port Macquarie. These collections are presumably represented somewhere within Cunningham's vast herbarium.

George Caley, when collecting in 1801 on James Grant's voyage of exploration down the south coast, was given special assistance by Governor King. King ordered Grant to aid Caley as much as possible 'by sparing him men for his assistance, exclusive of a soldier who is always to attend him on shore' (Currey 1967). Governor King may have thought that through this gesture he had the right to demand that all journals, drawings and collections 'worthy of notice of His Majesty's ministers or the Royal Society' be given to him for transmission to England. We have seen Caley's reaction to this previously.

It is known that William Baxter had the services of a convict when he visited King Georges Sound in 1829. In a letter reproduced by Maiden (1909), Lieutenant Sleeman at King Georges Sound wrote on 25 March 1829:

> I had the best vacant hut on the settlement prepared for Mr Baxter (Botanist) when he landed, and in order to contribute to his personal comfort as well as to enable him to proceed with more expedition in collecting and preserving the most valuable seeds and plants in this neighbourhood, I gave him the exclusive services of one of the most useful of the Crown prisoners, who attends him on all of his botanizing perambulations.

Baxter had sought the cooperation of the colonial government on his 1829 expedition. In return for a passage to King Georges Sound, the provision of collecting items and a regular ration, Baxter had offered half of his collections to the Sydney Botanic Gardens. On his return to Sydney, however, Charles Fraser, then Colonial Botanist, had to have the garden's half forcibly removed from the ship. It may have been this incident which accounts for the attribution of a collection of *Hakea denticulata* R. Br. in the Graham Herbarium in Edinburgh to Charles Fraser. The collector was almost certainly William Baxter, which affects the type status of the specimen (R. M. Barker, unpublished).

The convict John Richardson (?1797–1882)

John Richardson, the convict botanical collector, is almost unknown because of his status. A brief biographical sketch is provided from accounts in the *Australian dictionary of biography* and Andrews (1986).

Richardson, a nurseryman of Horsham, Sussex, was sentenced to seven years' transportation for larceny in March 1816. He arrived in Sydney in September 1817 and was presumably assigned to work in the government gardens. In 1821 'John Richardson, now a free man by absolute pardon, a gardener by profession ... [was] sent home in charge of a collection of Plants and Seeds of Australia on board the Dromedary'. In March 1822 Richardson was sentenced to death for housebreaking, his sentence being remitted to transportation for life. He arrived back in Australia, at Hobart Town, in November 1822 and was assigned work as a gardener. In May 1823, following a request from Charles Fraser, Colonial Botanist, he was able to accompany Fraser back to Sydney to become an overseer at the government gardens. Between 1823 and February 1826 his activities are obscure but it is possible that he spent some of the time on Oxley's surveying expeditions to the north of Sydney. In seeking a pardon for Richardson after the successful 1836 expe-

dition (this must have been at least his second pardon, ignoring the number of tickets of leave), Mitchell (Andrews l.c.) referred to 'his long service in the cause of science, he having also accompanied Mr Oxley'. Support for this is given by the fact that Richardson supplied seed of *Hibiscus richardsonii* from Port Macquarie to Colvills nursery before 1825. The plant was named after him by Lindley (1825). Similarly, *Alyxia richardsonii* (now *Alyxia ruscifolia* R. Br. of northeastern Australia) was named by Sweet (1827–1828) and recorded as being introduced from New Holland in 1823. In 1824 Richardson may also have accompanied William Baxter to King Georges Sound (R. Grandison, pers. comm. 1989).

In February 1826 Richardson was sent to Melville Island in charge of the garden for the new settlement to be made at Port Essington. In August 1826 he accompanied the *Mermaid* to Timor for a supply of seeds. With the failure of the settlement in 1829 he returned to Sydney on board the *Lucy Anne*, the government ship which picked up William Baxter's collection of seeds and plants from King Georges Sound (see previous section).

Having been granted a ticket of leave for Sydney on his return, Richardson fell on hard times. His wife died in 1830 and he continued to be in trouble until 1831 when his ticket of leave was revoked. He was then assigned to A. B. Spark of Cooks River. From this period until he was assigned to Mitchell's third expedition in 1836, nothing is known. We have already noted the anonymity which Mitchell accorded Richardson on this expedition. That he was 'indefatigable' on Mitchell's expedition, 'although an old man' (at the age of 39!), led to Mitchell recommending his conditional pardon (Andrews l.c.). Richardson eventually moved to Singleton, where he remarried and presumably mended his ways. He lived until the age of 85 but whether he continued to collect plants is not known to us.

C. James Drummond and his companion collectors

That James Drummond was not the only collector in his family has already been alluded to. His children took a keen interest in the plants of their area and in some cases were the first to recognize new taxa.

On most of his collecting trips James Drummond was accompanied by other people (Erickson 1975). His second collection in 1842–1843 was made in the company of the ornithologist John Gilbert, who presumably collected under his own name. His third expedition of 1843–1844 was undertaken with his son Johnston who, as we have already seen, at times independently collected and recognized plants, but there is no indication of this in Drummond's collections. The fourth collection to the 'South Coast' and the Stirling Ranges was made with George Maxwell. While Maxwell later made copious collections in his own name, many of which were sent to Mueller in Melbourne, it needs to be investigated whether his personal collections encompass the time spent with Drummond in 1847 or whether Drummond merely included Maxwell's collections under his own. Erickson (l.c.) states that this trip with Drummond was Maxwell's training ground. However, there is at least one, and presumably more, Maxwell collection from as early as 1838.[26]

D. Collectors on expeditions of discovery in Australia

Government sponsored exploring expeditions were provided with sets of instructions to their leaders (Gilbert 1986). A set of these instructions was relayed to Governor Macquarie in 1816 by the Secretary of State for the Colonies, Earl Bathurst. Amongst the requirements listed was a journal detailing observations and occurrences, however minute. Attention was to be paid to the animal, vegetable and mineral productions, with especial care to look for plants of any potential economic importance. Specimens of the most remarkable plants, animals and minerals were to be preserved, while seed collections were to be made of any unknown plants. Similar, at times word for word, orders were given by Governors Darling and Grey to Charles Sturt (Langley 1969), while, as already noted, Governor King had given similar instructions to James Grant in 1801.

One further significant instruction was the order, as, for example given to Sturt (Langley 1969), that at the end of the journey the leader was:

> to cause all the journals or other documents belonging to, and curiosities collected by, the several individuals comprising the expedition, to be carefully sealed up with your own seal and kept in that state until you shall have made your report ... in writing of the results of the expedition.

One recently discovered journal which escaped this monopoly of ownership of expedition journals, purportedly by being stitched inside an overcoat (Langley 1969), was that of Daniel Brock (Brock 1975) of the 1844–1845 expedition with Charles Sturt. It provides an at times damning insight into these arduous journeys from the point of view of one not in authority.

The exploring expeditions of the 1800s had a few officers or leaders of higher social status together with a larger number of men of lower status acting as personal servants, shepherds, blacksmiths, bullock drivers etc. Convicts often filled some of these latter roles. Mitchell preferred convicts to free men, even when the latter offered to participate without pay; 'the prospect of either liberty or reduction in sentence impelled them to render most satisfactory service' (Foster 1985, p. 373). The powers of the leaders were such that men could be discharged without pay at the end of months of hardship. John Mack the bullock-driver on Sturt's third expedition (Brock 1975), and Müller and Smith on John McDouall Stuart's third expedition were dismissed without pay because of disputes with their leaders (Stuart 1865).

In camp the officers ate and slept separately from the men. The bird-skinner Daniel Brock's description of making camp on Charles Sturt's 1844 expedition sheds light on the relationship between the two groups (Brock 1975):

> It would perhaps be well if I state how matters are arranged in our drawing into camp at night . . . Some time before the day's journey is completed, the horsemen ride ahead, when a convenient place is chosen. When we come up, the first thing we observe are the horses unsaddled and tethered. In the distance under a gum tree will be seen reclining Sturt, Poole and the Doctor. We draw up the drays so as to form a square, near to fallen timber for our fire. The bullocks are unyoked, and away they go, the drivers arranging their yokes for the morrow's start. The

Table IX
Known plant collectors on some of the exploring expeditions of the 1800s into the interior of Australia*

Expedition	Expedition designation	Date	Collectors	Party	General itinerary
Oxley	—	Apr.-Aug. 1817	A. Cunningham, C. Fraser	13	Lachlan and Macquarie Rivers, New South Wales
	—	May-Nov. 1818 1818	C. Fraser	?	Liverpool Plains, New South Wales
Mitchell	1st	Nov. 1831-28 Feb. 1832	?T. L. Mitchell	18	Namoi River region, New South Wales
	2nd	9 Mar.-mid Sept. 1835	R. Cunningham, T. L. Mitchell	23	Darling River, New South Wales
	3rd	c. Feb.-3 Nov. 1836	J. Richardson, T. L. Mitchell	25	Western Victoria ('Australia Felix')
	4th	1 Nov. 1845-20 Jan. 1847	W. Stephenson, J. W. Drysdale, T. L. Mitchell, others ('the party of men')	29	Eastern interior of Queensland
Sturt	1st	Nov. 1828-Mar. 1829	?	13	Darling River, New South Wales
	2nd	Sept. 1829-May 1830	G. MacLeay, C. Sturt	?8	Murray River
	3rd	June 1844-Jan. 1846	D. Brock, W. Lewis, Sullivan, Dr J. H. Browne	17	Inland eastern South Australia
Babbage	—	1858	D. Hergott	?	Lake Eyre region, South Australia
Leichhardt	1st	Aug. 1844-Dec. 1845	L. Leichhardt, J. Gilbert, the party in general	8	Moreton Bay (Brisbane) to Port Essington (north of present Darwin)
	2nd	Oct. 1846-July 1847	L. Leichhardt, D. Bunce	9	Abortive trip from Moreton Bay, Queensland, to Perth, Western Australia
	3rd	Feb.1848-	?	7/8	As above; never seen again
Stuart	1st	May-Sept. 1858	Possibly no collections	3	Lake Gairdner-Lake Torrens area, South Australia
	2nd	Apr.-July 1859	D. Hergott, ?L. Müller	4	Lake Torrens area, South Australia
	3rd	Nov. 1859-Jan. 1860	W. Kekwick, ?L. Müller; others ('we')	5	Lake Torrens area, South Australia
	4th	Mar.-Sept. 1860	W. Kekwick; others ('we')	3	Chambers Creek to West Neales to MacDonnell Ranges to Central Mt Stu(a)rt (centre of continent)
	5th	[?Nov.1860/ Jan. 1861]-Sept. 1861	W. Kekwick; others ('we')	10	Chambers Creek to James Range to MacDonnell Ranges to Tennant Creek to Newcastle Waters (abortive crossing of continent)
	6th	Dec. 1861-Dec. 1862	F. G. Waterhouse, W. Kekwick, J. Frew	10	As above to Newcastle Waters, then to Van Diemen Gulf, east of present Darwin
Giles	1st	4 Aug. 1872-31 Jan. 1873	E. Giles	3	Chambers Pillar, Ehrenberg Mts, central Australia
	2nd	4 Aug. 1873-20 July 1874	E. Giles, ?W. H. Tietkens	4	Central Australia as far as Gibson Desert
	3rd	13 Mar. 1875-6 May 1875	E. Giles	3	Eucla to Ooldea, far western South Australia, to Beltana, Flinders Ranges
	4th	23 May 1875-Nov. 1875	E. Giles, W. H. Tietkens, J. Young	6	Port Augusta to Perth via Great Victoria Desert
	5th	18 Nov. 1875-Aug. 1876	E. Giles	5	Perth to Pilbara region to Gibson Desert to Beltana

* It is difficult to know to what extent others, including party leaders such as Mitchell, were involved.

> drays are unlashed, the Captain's marquee is got out, and what spare hands there are turn to and pitch it. While this is doing the two cooks are getting up a fire, getting the dinner under way. After the marquee is pitched there is the Officers' bell tent; that is pitched, and against the camp stools, tables and bedding got in. It gets near time for dinner. If there have been no birds shot, I sometimes have to assist with the marquee, sometimes guarding the sheep.

It would appear that as a general rule if a naturalist or collector was considered one of the officers then his contribution was usually acknowledged on the collections and in the published journal. Thus, on Oxley's 1817 expedition Allan Cunningham and Charles Fraser collected in their own right, as did Richard Cunningham on Mitchell's 1835 second expedition and the surgeon J. W. H. Browne on Sturt's 1844 expedition. Collectors on the various expeditions treated, as far as can be established, are listed in Table IX.

The surgeon William Stephenson

Reference has already been made to William Stephenson's involvement in Mitchell's fourth expedition in 1846 to central Queensland as the party's 'Surgeon, and Collector of objects of Natural History'. Although one of the officers, there is some doubt about due credit being accorded to him as collector. Apparently he was dragged before the courts by Mitchell for withholding botanical and other natural history items (Gilbert 1981), for which he was found not guilty. We have not seen or heard of any collections which have been attributed specifically to any of Mitchell's per-

sonnel on his four expeditions. All Mitchell expedition specimens seen have printed labels bearing only Mitchell's name, or hand written labels with 'Major Mitchells Expedition'. As we have already seen, in his account of the fourth expedition Mitchell occasionally credited Stephenson and others in the party with the collection of specific plants. Yet, in terms of annotating specimens with the collector's name, Stephenson the surgeon appears to have been treated like Richardson the convict.

Collections attributed to Stephenson do occur in herbaria. All seen were made either before or after the Mitchell expedition, often with the printed general locality, 'within 125 miles of Sydney'.

Charles Sturt's expeditions

Captain Charles Sturt (1833) voyaged down the Murrumbidgee and Murray Rivers in 1829–1831. Whether plant collections were made on the journey is unclear from his published account. Reference is made to his second-in-command George McLeay 'who was always indefatigable in his pursuits after subjects of natural history' and to a 'brush, in which there was a new species of melaleuca'. Near the end of the journey the carpenter, Clayton, was directed 'to make some plant cases of the upper planks of the boat', implying that collections had been made. Confirmation of at least one collection is given by Robert Brown (1849) in his appendix to Sturt's later expedition to central Australia (Sturt 1849) where he refers to a collection of *Jasminum lineare* R. Br. from this journey.

On his later expedition in 1844–1845 to central Australia in search of the inland sea which Sturt was convinced existed there, collections of 'about 100' species were made. In briefly introducing the appendix, Robert Brown (l.c.) referred to the collections of Sturt and 'Brown', actually the doctor J. H. Browne. However, Sturt's name alone appears as the collector of most of the about 35 species dealt with in the account. For the remaining species no collector is given.

Examination of another account of this expedition by the bird-skinner Daniel Brock (Brock 1975) reveals that the men, as opposed to the officers, were involved in the collecting at least of seeds. This activity was singled out in the expedition's orders (Langley 1969, p.250):

> It is further expected that you will, as far as may be in your power, attend to the animal, vegetable and mineral productions of the country, noting down everything that may occur to you and preserving specimens as far as your means will permit, especially some of all the ripe seeds that you may discover.

William Lewis, previously a sailor but employed as a bullock driver, Sullivan (no Christian name and not contained in Sturt's list of personnel[27]), assistant to Brock in charge of the sheep, and Brock were all at some time engaged in this activity. It is possible that they collected plants for Sturt. In fact, in listing his party, Sturt refers to Brock as his collector (Sturt l.c.).

There is one instance where the party's collecting activity is referred to in both accounts. On 23 December 1844 Brock's comment is: 'Lewis goes to gather seeds', while Sturt says of the same day: 'The seeds were ripening fast along the banks of the creek, and we collected as many as we could'.

Further notes by Brock on collecting activity are found in the entry for 18 December 1844: 'Lewis, having been out gathering seeds, fell in with us'; for 21 February 1845: 'Mr Poole having given me and Sullivan instructions to push down the creek (east) to procure acacia seeds and also birds (Mr Poole is very anxious to get seeds for some friends of his in 'Ould Ireland' — but this is under the bush) . . .'; for 22 February 1845 'Lewis, being out looking for seeds, . . .'; for 23 February 1845: '[Brock was] engaged in part in looking for seeds'; for 13 March 1845 '[Brock was] busy this morning in gathering seeds'

Ludwig Leichhardt's expeditions

Ludwig Leichhardt's expeditions were sponsored not by the government but privately by landholders and Sydney merchants. The number in the party was much smaller and there was not the same distinction between officers and men as shown in the government expeditions. We have already seen in the previous section Leichhardt's description of his activities while on expedition but the following account reproduced by Roderick (1988, p. 294) seems more balanced. Leichhardt wrote that on rising,

> a loud cooee then rouses my companions, — Brown to make tea, Mr. Calvert to season the stew . . . and myself and the others to wash, and to prepare the breakfast . . . [By the time breakfast is served] Charley generally arrives with the horses, which are then prepared for their day's duty. After breakfast, Charley goes with John Murphy to fetch the bullocks, which are generally brought in a little after seven o'clock A.M. The work of loading follows . . . and, at about a quarter to eight o'clock, we move on and continue travelling four hours, and, if possible, select a spot for our camp . . . As soon as the camp is pitched, and the horses and bullocks unloaded, we have all our allotted duties; to make the fire falls to my share; Brown's duty is to fetch water for tea; and Mr. Calvert weighs out a pound and a-half of flour . . . during the afternoon, every one follows his own pursuits, such as washing and mending clothes, repairing saddles, pack-saddles, and packs; my occupation is to write my log, and lay down my route, or make an excursion in the vicinity of the camp to botanize, &c., or ride out reconnoitring. My companions also write down their remarks, and wander about collecting seeds, or looking for curious pebbles. Mr. Gilbert takes his gun to shoot birds. A loud cooee again unites us towards sunset round our table cloth.

Leichhardt was not the only collector of plants on the Port Essington expedition (Table IX). All three biographers of Leichhardt (Chisholm 1973; Webster 1980; Roderick 1988) mention that John Gilbert and Leichhardt fell out over collections. Their interpretations vary, but it would seem that the undertaking was that bird collections were to go to Gilbert's employer, John Gould, along with the second collection of any quadrupeds. The first collection of any other fauna and plants were to go to the Australian museum with duplicates to Paris or London (Roderick l.c.). According to Webster (1980, p. 385), Gilbert had authority to buy natural history items for Gould and he was also given 10% of sale of specimens which Gould did not want to keep. Roper at least is reputed to have given specimens to Gilbert rather than Leichhardt in the hope of benefiting financially.

As has already been mentioned in the previous section on Leichhardt, Daniel Bunce collected on the aborted east-west crossing. He was keen to accompany Leichhardt on his next expedition as well, but by this time news of Bunce's previously bad character (Roderick l.c., p. 401) had reached Leichhardt, who declined to make Bunce one of his new party. Presumably it was Leichhardt's intention to make his own collections as no collector accompanied this final party.

David Hergott on Babbage's expedition

David Hergott (sometimes 'Herrgott') was the 'General Assistant and Botanist' on B. H. Babbage's expedition to the north-west interior of South Australia in 1858. While Mueller (1859) acknowledged briefly in the introduction to the collection that the herbarium 'was compiled by Mr David Hergolt [sic]' and did 'credit to his skill and industry' no further mention is made of his contribution. Throughout the descriptions reference was made to Babbage's collections! New genera and species were described. Persons commemorated included Kriehauff and Dutton, promoters of the expedition, Governor MacDonnell and his secretary, Paisley, Ronald Gunn, the Tasmanian collector, and Richard Kippist, librarian of the Linnean society. The genus *Babbagea* was named after the expedition leader but, as pointed out by Maiden (1908a), Hergott received no commemoration.

Following Babbage's expedition Hergott joined the second of Stuart's expeditions, discussed below, and then (Anonymous, undated) guided Alexander Tolmer's ill-founded search east of Lake Torrens for a shorter route than Stuart's to the centre of Australia. Tonkin (1985) states that Tolmer had offered to accompany Stuart's third attempt to cross the continent from north to south as second-in-command but when he found that he was being used only to help get the expedition together, he organized his own.

John McDouall Stuart's expeditions

Perusal of John McDouall Stuart's (1865) publication of the journals of his explorations into central Australia from 1858 to 1862 reveal that he was not the only person who collected on his expeditions. It is known that F. G. Waterhouse (initials wrongly cited by Stuart as J. W.) was naturalist on the successful crossing of Australia from south to north between December 1861 and December 1862, his last expedition. In enumerating the plants collected on Stuart's six expeditions in the appendix to this work, Mueller (1865) indicated those which were collected by Waterhouse. The remaining specimens are either attributed to Stuart or have no collector indicated. A search of Mueller's *Fragmenta* produced at this time revealed no acknowledgement of other collectors.

Other people did collect plants for Stuart. During the 1859 second expedition he was accompanied by Hergott, the botanist on Babbage's expedition, and Louis Müller. There is one reference to a botanist: 'I sent Campbell (my stockman) in one direction and Müller (the botanist) in the other'.

We have been unable to find any reference to Louis Müller except for a passing comment (Anonymous, undated, p. 1025) that he was a gold prospector; the search for gold during Stuart's 1859 third expedition when Müller was again present bears this statement out. If any plants were collected, however, and this seems likely as there is a reference to finding new plants in Chambers Creek on 5 May 1859, it is much more likely that the collector would have been Hergott, as he had already acted in this capacity on Babbage's 1858 expedition. The reference to Müller as the botanist may have been a slip by Stuart's London editor in the mistaken belief that the Müller referred to was the better known Ferdinand.

On Stuart's fourth, fifth and sixth expeditions, there is clear reference to William Kekwick as the collector of plants along with less specific statements on general collecting by the party. Thus on 24 April 1860 at Central Mt Stuart there appears the statement that:

> Kekwick returned in the afternoon, having found water higher up the creek. He has also found a new rose of a beautiful description, having thorns on its branches and a seed-vessel resembling a gherkin. It has a sweet, strong perfume; the leaves are white, but as the flower is withered I am unable to describe it.

On the fifth expedition on 28 April 1861 at Tomkinson Creek following the general: 'We have found many new plants and flowers, also some trees' there follows: 'Mr Kekwick, in looking for plants this morning, discovered one which very much resembles wheat in straw (which is very tough), ear and seed.'

Again on the sixth expedition, even though Waterhouse was present as naturalist, we have on 21 June 1862 at the first camp north of the Gorge on River Strangways 'Mr Kekwick still finding new shrubs'; on 14 July 1862 at The Mary, Adelaide River 'We have passed a number of trees resembling the iron-bark, also some like new ones, and many shrubs, which Mr Kekwick has found'; and on 24 June 1862, at Mussel Camp, River Strangways 'Mr Kekwick found cane growing in the bed, and also brought in a specimen of a new water-lily — a most beautiful thing it is; it is now in Mr Waterhouse's collection'.

James Frew, whose occupation in the party was not listed, although Stuart refers to his approval of his care of the horses in naming Frew's Waterhole, also discovered at least one plant. Stuart recorded on 20 June 1862:

> Frew, in looking about the banks, found a large creeper with a yellow blossom, and having a large bean pod growing on it.

Collectors associated with the explorer Ernest Giles

Ernest Giles was sponsored in his earlier expeditions in central Australia by Ferdinand von Mueller and there is no doubt that he collected many plants for Mueller which now reside in the National Herbarium of Victoria. Those plants from Giles's expeditions of special interest, many of them new, were described in detail in the ninth and tenth volumes of Mueller's (1852–1882) *Fragmenta phytographiae Australiae*. In these he referred to collectors and their localities. The five expeditions made by Giles were described in his work (Giles 1889) *Australia twice traversed*. Mueller (1889) summarised the botanical results of the first two expeditions of 1872–1874 in an appendix to the second volume.

All plants from the later expeditions were treated by Mueller (1877) in his 'List of the plants obtained dur-

ing Mr C. Giles's travels in Australia in 1875 and 1876'. The use of 'C.' instead of 'E.' in the title is an obvious slip as the majority of collections came from Ernest Giles and the introduction is devoted almost entirely to him. However, throughout the list there are separate references to 91 collections made by C. Giles. A myth has been perpetuated that Christopher was a brother of Ernest Giles; the earliest reference seen to this is by Maiden (1908a). Furthermore, Christopher is purported to have collected on Ernest's earlier expeditions (Maiden 1908a; Willis 1981; Kraehenbuehl 1986), despite Mueller's inclusion of Christopher's collections with the results of Ernest's last three expeditions.

According to Ericksen (1978) Ernest Giles had one brother named Robert. There appears no evidence that he ever collected plants or visited central Australia. In addition the journals for the expeditions concerned (Giles 1889) make no mention of a collector and Christopher Giles was not listed in either party. Nor did Ernest Giles on these expeditions visit the MacDonnell Ranges or Charlotte Waters, the collecting localities of Christopher Giles. Overlooked has been the fact that Mueller (1877) introduced the list, based as it was mainly upon the collections of Ernest Giles, with the comment that: 'Some plants from small collections secured by other recent explorers are also added'. Ernest Giles (1889) referred to Christopher at one point in his published journal of the first expedition in naming a landmark on 28 August 1872: 'I named it Christopher's Pinnacle after a namesake of mine.' He would surely have referred to him as his brother if it were so.

There is no evidence that Christopher Giles was a relation of Ernest Giles, nor did he ever collect or participate on Ernest's expeditions. Christopher Giles could well have been involved either with the Gosse expedition to central Australia in 1873 or more likely with the surveying of the overland telegraph which took place in the area at that time. Reference is made to the journal of an Alfred Giles who was involved in reconnaissances for the telegraph (Anonymous, undated). He must also have collected for *Bauhinia gilesii* was named after him (Mueller & Bailey in Mueller 1882). Those collections of Christopher Giles which have been seen in the National Herbarium of Victoria have all been dated May 1875.

In keeping with our theme of overlooked collectors, it is ironic that, despite Mueller's (1875) naming the genus *Gilesia* jointly after Christopher and Ernest Giles, subsequent botanical works (e.g. Black 1952; Baines 1981; Jessop 1986; Elliot & Jones 1986) have invariably assumed the genus to have been named after the more eminent of the two. Mueller (1875, translated from the Latin) wrote:

> The name of this new genus has been dedicated to the learned Christopher Giles, discoverer of many central Australian plants and of this very species, as well as to the now renowned geographer Ernest Giles, who also always collected a large number of plants on his arduous explorations.

Another collection included in Mueller's (1877) list is the 61 specimens gathered by 'Lewis' from Lake Eyre. This was presumably John Lewis who led a government expedition to Lake Eyre in 1874–1875 to find out whether its waters were navigable and to explore the nature of the country east and north. The only other collectors mentioned related to single specimens. One from between Eucla and Fowler's Bay was by 'Richards', probably the police trooper referred to by Ernest Giles on his third expedition as guiding Giles in 1875 to Youldeh (Ooldea) from Fowler's Bay. His wife Annie sent Mueller extensive collections from Eyre Peninsula between 1873 and 1894 (Kraehenbuehl 1986). The other collection was by the explorer William Gosse from the Musgrave Ranges.

Although in the introduction to the list of plants from Giles's later expeditions Mueller (1877) stated that Jesse Young and Mr Tietkens formed extensive collections on Giles's fourth expedition (Mueller cited it as the third), he did not indicate which of the collections were attributable to them. Mueller's (1875–1877, vols. 9–10) *Fragmenta* volumes indicate those collections of Young and Tietkens which proved to be new or of particular scientific interest. These collections came to Mueller by way of the expedition sponsor, the pastoralist Sir Thomas Elder (Mueller 1877); the other collections were presumably forwarded by Giles directly to Mueller. Tietkens had also accompanied Giles on his second expedition, but it is not known whether he made any collections on this journey.

Tietkens later led his own expedition in central Australia and plant specimens were again forwarded to Mueller. In Mueller and Tate's (1890) account of the specimens 'collected by Mr Tietkins and his assistants' the identity of these assistants is unknown.

V. Which name to which plant?: history in nomenclature

> *The application of names of taxonomic groups is determined by means of nomenclatural types.* (ICBN, Principle II)
>
> *Each taxonomic group with a particular circumscription, position, and rank can bear only one correct name, the earliest that is in accordance with the Rules, except in specified cases.* (ICBN, Principle IV)

The rules of application of plant names, detailed in the *International Code of botanical nomenclature* (abbreviated to ICBN or *Code*), are greatly involved with history in several areas. Firstly, there is a rule of priority whereby the correct name is usually the earliest published for a particular taxonomic group (a 'taxon'). It is therefore necessary to establish the publication dates of literature, a major function of *Taxonomic literature* (Stafleu & Cowan 1976–1988). Secondly, modern rules of nomenclature require that a 'type' specimen be designated when describing a plant for the first time. A plant name is associated with this particular specimen for all time. Because it has been obligatory that a type be designated only since 1958 (Art. 37), names published prior to that date, particularly from the last century when there was no type concept, have often not had a type designated when published. Accordingly, as part of the process of establishing the names of plants, each old name must have a specimen selected as its type. The determination of the type of a name ('typification') may involve an investigation of who was involved in the provision of the specimens,

the name and the description of the taxon involved. The authorship of a name may be some guide to those involved, but, as will be seen, cannot be taken to encompass all.

A. Typification: a search into the historical background of a name

Typification of names for which no holotype was designated should only be carried out with an understanding of the author's method of working . . .(ICBN, Rec. 7B.2)

Designation of a lectotype should be undertaken only in the light of an understanding of the group concerned. In choosing a lectotype, all aspects of the protologue should be considered as a basic guide . . .(ICBN, Rec. 7B.3)

In choosing a lectotype, any indication of intent by the author of a name should be given preference unless such indication is contrary to the protologue. Such indications are manuscript notes, annotations on herbarium sheets, recognizable figures, and epithets such as typicus, genuinis, vulgaris, communis, etc. (ICBN, Rec. 7B.4)

In selecting a neotype particular care and critical knowledge should be exercised, because the reviewer usually has no guide except personal judgement as to what best fits the protologue, and if this selection proves to be faulty, it will inevitably result in further change. (ICBN, Rec. 7C)

Where there is only a single specimen used or designated by the author as the nomenclatural type, the specimen is called the 'holotype' of the name (Art. 7.3). Where there is no such single specimen, a specimen called the 'lectotype' must be chosen from the material used in the compilation of the description of the taxon (Art. 7.4, 7.5). Such a specimen needs to carefully selected (see text quoted above). Frequently, some knowledge of the botanical activities of the author is required. If no such material exists (it may have been lost or the name may have been based on living material), a substitute specimen or 'neotype' must be chosen (Art. 7.4, 7.9; text quoted above).

As a result of these rules, taxonomists reassessing names should obviously be aware of the source of all information presented in the protologue. In other words, the possibility of unacknowledged contributions to the documentation of plant names should be considered in all typifications. As we have shown, the manuscripts of Solander and Dryander are obviously important to the typification of Robert Brown's Australian names in particular, but to date they will have been rarely consulted in revisional studies. In the interests of more informed typifications, it would be of great benefit to have their manuscripts investigated and microfilmed in the same way as Brown's manuscripts have been (Burbidge 1955).

In the interests of stable nomenclature the *Code* does not allow for a selected type to be superseded unless it is in serious conflict with the protologue (Art. 8). This adds further to the need for care in the initial selection of a lectotype or neotype.

Finally, the *Code* (Rec. 34A; see also Rec. 23B.1.i) recommends against the publication of a previously unpublished manuscript name which is not being taken up as a name. We disagree. In some cases the publication of manuscript names in synonymy should be encouraged. They can provide clues to the existence of obscure specimens and manuscripts upon which the documentation of a name may have been based. For example, lack of citation of Solander's manuscript names in literature of the past has undoubtedly led to many typifications of Brown's Australian names without reference to the involvement of Solander and Banks. Brown (1810b) did not always refer to his use of his predecessors' specimens and manuscript under each species he described in his *Prodromus* (Table I, V). One of us typified *Justicia juncea* R. Br. (R. M. Barker 1986) without knowing of Solander's contribution of the epithet in the form of 'Dianthera juncea' (Table I). Brown did not cite the Banks and Solander specimen in the protologue of the *Justicia*, but because he took up Solander's epithet and presumably was influenced by Solander's concept of the species, the Banks and Solander specimen should have been considered in lectotypifying this name.

Old specimens may have a confusing array of unpublished names upon them. Some may represent the unpublished contributions of several botanists. Identification of handwriting is accordingly an important field of investigation (e.g. McGillivray 1973; Anonymous 1983), for annotations are often not accompanied by the writer's name. Sometimes a series of names may represent the developing ideas of one worker. For example, Robert Brown initially on his herbarium material and in his manuscripts applied his names *Euphrasia collina* and *E. speciosa* to different species from those in his publication (Brown l.c.) and gave other names to these two species (W. R. Barker 1982). It is important that the changing views of workers be included in taxonomic studies to avoid later confusion.

B. Authorship of botanical names: an evolving citation?

For the indication of the name of a taxon to be accurate and complete, and in order that the date may be readily verified, it is necessary to cite the name of the author(s) who validly published the name concerned... (ICBN, Art. 46.1).

When a name of a taxon and its description or diagnosis . . . are supplied by one author but published in a work by another author, the word 'in' should be used to connect the names of the two authors. When it is desirable to simplify such a citation, ***the name of the author who supplied the description or diagnosis is to be retained.*** (ICBN, Art. 46.2, our emphasis, see below).

When an author who validly publishes a ***name*** *ascribes it to another person . . . the correct author citation is the name of the validating author, but the name of the other person, followed by the connecting word 'ex', may be inserted before the name of the validating author.* (ICBN, Art. 46.3; our emphasis, see below).

Authors' names are cited as part of botanical names for 'purposes of precision' (Section 3 heading preceding Art. 46). This precision can be useful in different areas. Firstly, identical names ('homonyms'), independently formulated by different authors, can be readily distinguished by their author citation. Secondly, the author citation has a bibliographic function, insofar as it represents a useful abbreviation of the full literature citation of the place of original publication (the protologue) of the name and its date. Thirdly, the *Code*

requires that the author or authors 'validly' publishing the plant name and its description be credited with authorship. Article 46.1 is possibly somewhat ambiguous in this, but 46.2 (see emphasised section) indicates clearly that the contributor of the description, not simply the author of the article, if different, is to be cited. There is no requirement that the author be mentioned in the publication itself.

Where authorship has been made clear in the protologue, the *Code* provides an easy set of guidelines to citation, quoted above. Even under these rules, however, authorship has been often wrongly attributed for many years. For example, in updating the nomenclature and taxonomy of the flora of South Australia, Eichler (1965) made many changes to long-standing author citations by applying these rules.

An example of a continuing error in citation is that of Richard Kippist's contribution to the Proteaceae. Kippist was Librarian to the Linnean Society in the mid 1800s and was keenly interested in the taxonomy of Australian plants (Mueller 1858). Kippist assisted Carl Friedrich Meisner in contributing the descriptions and often the names of at least 12 new species among the 66 Australian Proteaceae published in Meisner (1855). Many of the species were described from Drummond collections. Meisner (l.c.) had not seen Drummond's fifth set and its supplement. For these Kippist provided Meisner with 'very accurate definitions, partly accompanied with drawings and fragments, of such *Proteaceae* ... as he found to be new. . .'. Meisner also clearly acknowledged Kippist as the sole contributor under each of these species. A year later, in his monograph in de Candolles' *Prodromus*, Meisner (1856) again omitted reference to himself as author, with citations such as 'Kipp. in Hook. . . .'. Bentham (1870b) followed suit, although generally using the ambiguous citation 'Kipp.; Meisner in Hook.'. Yet ever since the incorrect citation of the authorship of these names in *Index Kewensis* (Jackson 1893) Meisner has been consistently attributed principal authorship with 'Kippist ex Meisner'. The 12 names, in the genera *Petrophile, Conospermum, Persoonia, Grevillea, Hakea* and *Dryandra*, should all be attributed solely to Kippist's authorship. The choice of lectotype for these 15 species should be the Drummond material studied by Kippist. He studied the collections owned by Mr W. W. Saunders and compared them with those in 'several London herbaria'. The relevant *Hakea* specimens are in the Saunders herbarium at Kew; there are no fragments in the Meisner Herbarium.

Three species are described in Meisner (1855) from Drummond's fifth series under Meisner's authorship. From *Grevillea leucopteris* Meisner deliberately excluded the flowering and fruiting specimens which Kippist had described. In the case of *Persoonia striolata* Meisner supplied the name. Kippist apparently supplied its description, provisionally calling it *P. striata* R. Br. (Meisner 1856). Its authorship should accordingly be cited 'Meisner ex Kippist. . .'. In the case of *Hakea kippistiana*, Kippist indicated that Meisner had wrongly applied the name *H. tephrosperma* R. Br. to material of the species previously collected by Drummond. Kippist supplied an illustration of the fruit. It is arguable that Kippist should be treated as a joint author of *H. kippistiana*.

Dealing with cryptic authorship

This paper has highlighted evidence for a number of cryptic contributions to the publication of names. For example, Solander and Dryander have been credited inconsistently with authorship of plant names published under the name of others, their citation often dating from literature appearing soon after the protologue. Similarly, if we accept that Salisbury co-authored Knight's (1809) treatise on the Proteaceae, should not authorship of the species names be cited as 'Knight & Salisb.', *vice versa* or in some other way showing Salisbury's involvement?

The *Code* in its present form does not give clear guidance to dealing with contributors omitted from the protologue, whether they provide names, descriptive matter or both. Why the concern? Firstly, of course, a clear indication of how authorship must be determined would assist in putting the authors cited and those actually involved into a more obvious perspective. Citations are taken by many as reflecting the relative contributions of individuals to the recognition of new plants. We suggest that this would even occur were authorship demoted to a purely bibliographic role (dropping 'in' and 'ex' and their preceding authors). Secondly, authorship is an important guide to those typifying names. We have indicated in the preceding section that decisions on typifications are too often made without recourse to manuscripts and all specimens utilized by the author of the new plant.

The present rules of nomenclature regarding crediting authorship of a name to the non-publishing author using 'ex' allow for an interesting anomaly. In one situation, Gunn may suggest that Hooker name a species after his colleague Lawrence without ever communicating the binomial (genus name and species epithet). Despite this, if Hooker attributes the name to Gunn in the protologue, we have a citation 'Gunn ex Hooker'. In a second situation Solander provided the unpublished name 'Dianthera juncea' which Brown (1810b) published as *Justicia juncea*. Even if he had acknowledged Solander as provider of the epithet, Solander receives no credit in the authorship. He supplied the epithet alone, not the full 'name' (by definition the combination of the genus name and species epithet), which is required by Rec. 46E (see emphasis in quotation above) for citation as author. As a result an indication in the author citation of Solander's contribution to the publication of the species is lost.

We make two suggestions for citing 'cryptic authorship'. One involves the use of the Latin word 'apud', meaning 'in the writings of' which was in use earlier this century as an alternative to 'ex'. Mr H. K. Airy Shaw (pers. comm. 1982) also used this term in situations of complex authorship. Our suggestion is to use it in the same way as 'ex' where the preceding, in this case, unmentioned contributor to the descriptive portion of the protologue, could be dropped. Thus, where Robert Brown (1810b) had taken descriptive material from Solander, 'Solander apud R. Br.', or where Brown also contributed, 'Solander & R. Br. apud R. Br.', or, alternatively, 'Solander p.p. apud R. Br.' could apply ('p.p.' being an abbreviation for the Latin 'pro parte' meaning in part). As now, the contracted form of the citation would be 'R. Br.'. In this way author citations could be improved as knowledge of the background to

the initial publication of names important to typification comes to light.

The second approach could be the use of square brackets around cryptic authors together with 'in' and 'ex' as defined in the rules, as adopted by Mabberley (1980).

The citation of authorship of plant names can never be expected to do justice to all those involved in documentation of the plant through to publication of its name. The present rules governing author citations are variously interpreted, leading to inconsistencies. In one example we have presented, Kennedy is rarely cited in the modern literature as the author of descriptions in Andrews's *The botanical repository*, while Ker-Gawler, in a parallel case, is consistently cited as author of those in Edwards's *The botanical register*. The case of Kennedy is readily soluble, since his contribution is referred to in *Taxonomic literature* (Stafleu & Cowan 1976–88). A nomenclatural committee has been set up in an endeavour to improve the situation. Whatever recommendations it makes, determination of authorship will often remain a complex and controversial matter, particularly in the cases of old names where evidence of authorship continues to be tenuous.

VI. Conclusion

The citation of the authorship of a botanical name does not necessarily acknowledge all those involved in its foundation. Similarly, the title pages of many of the early botanical publications dealing with new Australian plants do not truly reflect major contributions by others. Many more people contributed to published names than is presently recognized. Our selection of examples demonstrates that botanists, collectors, explorers, gardeners and others associated with the documentation of the Australian flora through the collection, recognition, description, illustration and naming of new plants have been unacknowledged or overlooked.

In contrast to those overlooked are the many whose contributions to our knowledge of the Australian flora have been significantly overstated. Robert Brown, for instance, gained much of his prestige at the expense of Daniel Solander, Jonas Dryander, Richard Salisbury and Peter Good. Sir Thomas Mitchell and Captain Charles Sturt's names appear on many occasions as plant collectors, despite their expeditions having personnel whose duty it was to collect.

The right to the ideas of those in one's employ or under one's command had much to do with this unequal apportionment of credit in the literature. Solander and Dryander were employed by the patron of science Joseph Banks. Their unpublished knowledge was freely available to the scientific establishment of the day. Their successor, partly because of Banks's waning power and interest and partly because he was one of that establishment, was able to claim authorship of his own work. Brown was also able to incorporate some of Solander's and Dryander's work under his name. Major contributions to the generic classification of the Proteaceae by Richard Salisbury were bypassed in favour of Brown's more refined but later concepts by the scientific establishment.

The suppression in the botanical literature of manuscript names has left the present taxonomic community ignorant of the need to consult particular manuscripts and other evidence. Such unpublished materials and associated specimens may be important in determining the correct application of old names to plants. It is important that this unpublished evidence be made more accessible.

This paper also serves to highlight the necessity to publish results. Failure to do so in the cases of Solander, Allan Cunningham and Leichhardt has led to their results being either published by others or superseded.

With an increased awareness of Australian colonial history, critical accounts are now being prepared by historians on the activities of the explorers (e.g. Beale 1979; Webster 1980; Carter 1987; Roderick 1988). Such a searching spotlight turned on them will no doubt provide a more balanced view of the people behind the usually flattering portraits presented in their diaries, and perpetuated in scores of biographies and Australian history books. Leichhardt, traditionally portrayed as incompetent, is one who has benefited from recent investigations. Such works also give an insight into the activities of the members of the party and provide us with further background to particular collections.

We conclude by reproducing Peter Good's plea to Joseph Banks on 6 May 1801 (Edwards 1981b) just before he left for New Holland. His letter surely expresses the feelings of many knowledgeable Australian collectors who were to follow him:

> The Miner [John Allen] and I were told that we must give up every article of our discovery and collections of every kind to Mr Brown when collected to be by him labeld and stored up &c. So that it appears to me that every article of our industry and collections shall become the immediate property of Mr Brown except only so much as may be selected by the Lords of the Admiralty and also the Seeds and living plants which I understand to be wholly intended for His Majestys collection, and will entirely deprive the Miner and me from being able to present the Lords of the Admiralty with the most trifling Article or deriving any benefit from that article of indulgence. I earnestly wish an explanation on the subject, as also to know whether I will be permitted the honor of being recorded as the introducer of such plants and seeds as I shall be able to collect to introduce.

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Notes

1. Cited in Marshall (1984). Alströmer was president of the Swedish Royal Scientific Society.
2. William Anderson the horticulturist and Alexander Anderson, gardener in charge of the botanic gardens on the island of St Vincent, were also honoured by this name.
3. This practice of changing inappropriate names was by no means unique to Salisbury. Smith himself did not hesitate to advocate this when it suited, as in his preference for *Conchium* over the earlier *Hakea* (Smith 1808; Mabberley 1985), in his 'choosing the best names afforded by those writers for such species as are not altogether new' (Smith l.c.), and his preference for *Gompholobium fimbriatum* over his own earlier *G. latifolia* (Smith 1804). Brown also made many changes to names of already established genera; many of these new names were later legalized by the procedure of conservation. Examples from families other than the Proteaceae, cited above, are *Logania* which was preceded by *Euosma* Andrews published in 1808, and *Thysanotus*, which was preceded in 1808 by *Chlamysporum* Salisbury (Britten 1886a).
4. Letter, dated 6 December 1843, from Ronald Gunn to W. J. Hooker; cited in Burns & Skemp 1961.
5. Charles Greville (1749–1809) (Assistant Secretary 1942) was a close friend of Joseph Banks. He was a Lord of the Admiralty and vice-president to Banks of the Royal Society. It was to Greville that Banks wrote when he wished Peter Good to be sent as a gardener on the voyage of the *Investigator*. In addition Greville grew a number of plants which were first described in the illustrated magazines of the day. He was a founding member of the Royal Horticultural Society.
6. Banks Papers, Mitchell Library, reproduced in Currey (1967). John Lewin was a naturalist and artist whose chief collections were insects and birds (Finney 1984); he arrived in the colony in 1800 and continued to paint the flora and fauna until his death in 1819. Col. Woodford was of the War Office.
7. Dixon Library ref. ZPXX2
8. Banks Papers 18, Mitchell Library, ref. A81.
9. Letter, dated 27 May 1799, from Bass to Banks; reproduced in Bowden 1952.
10. Letter dated Jan. 1793 from Monterey, California; reproduced in Galloway & Groves 1987, p. 17.
11. Dawson Turner Catalogue 11.116–117.
12. John Lindley to Thomas Mitchell in 1837 or 1838 on two *Calostemma* species: *Mitchell papers*, vol. 6, *Miscellaneous* A295/1, p. 73, Mitchell Library.
13. The specimen is in fact the lectotype of *E. multicaulis* Bentham. Label data cited in Barker (1982, p. 189).
14. William Macarthur of Camden on Leichhardt, cited in Gilbert (1986).
15. Webster (1980) records that there were 270 goats, 108 sheep, 40 bullocks, 15 mules and 14 horses.
16. Roderick (1988) records that there were 20 mules, 6 horses and 50 bullocks.
17. In *Mitchell papers* vol. III. *1830–1839* A292, vol. VI *Miscellaneous* A295/1, Mitchell Library.
18. The attack at Mt Dispersion resulted in aboriginal deaths and prompted a highly publicized official enquiry. There are conflicting versions of what prompted the attack. In his diary and his published account (as reported in Cumpston 1954; Foster 1985; Andrews 1986), Mitchell attributed it to a defence from repeated threats of hostility by the Aborigines of the region. His men corroborated this in the subsequent enquiry. However, a later description of the aboriginal version of events recounted by Daniel George Brock (1975) in his diary of Sturt's 1844 expedition is conflicting and more sinister. According to members of the 'very tribe which were so shamefully injured by Mitchell's party', the conflict had resulted from the shooting of a female native and butchery of her child by one of Mitchell's men. The victim had approached him for the kettle which he had promised in return for sexual favours. The significance of Mitchell's modification of his diary in the days surrounding this incident, particularly with his erasure and rewriting of a large portion of his account on the fateful day, does not seem to have been considered by historians. Nor does the suppression of the wounding of an aborigine in western Victoria which concludes Mitchell's diary entry of 28 July 1836 seem to have been alluded to in the past; Mitchell's marginal comment to a person handling his text for the published version was surely not indicative of his true motives for excluding the detailed account: 'Leave this out W. Graham for fear of shocking the three old ladies'. The incident obviously was of great concern, for on that very night Mitchell buried salt, horseshoes and other articles of little anticipated use, another important event unusually and deliberately omitted from his publication. The recently published diary of Mitchell's second in command, Granville Stapylton (Andrews 1986) also contains reference to this incident (quoted here on p. 68), and indicates a general antipathy by Mitchell's party to the Aborigines. Stapylton's diary, in the Mitchell Library, is not the original (Andrews l.c.), making omissions of controversial facts possible.
19. The genus *Victoria* and its type species *V. regia* (now *V. amazonica*) are attributed to the authorship of Lindley. Lindley certainly supplied the name but he wrote (Lindley 1838) concerning the initial publication: 'At the time . . . I knew nothing of the plant beyond what could be learned from Mr. Schomburgk's description and figures'. As Lindley apparently did discuss the rank to be attributed to the plant, authorship of the species and genus should be attributed to both men, e.g. as 'Lindley ex Schomburgk & Lindley'.
20. *Mitchell papers* vol. VI *Miscellaneous* A295/1, Mitchell Library.
21. *Mitchell papers* l.c., p. 82 (undated letter).
22. *Mitchell papers* vol. III. *1830–1839* A292, p. 365. Mitchell Lirary.
23. For an account of his early life and frustrations see Farber (1985).
24. Letter reproduced in Daley 1927.
25. Quoted in Webster 1980.
26. Maxwell 2, *Hakea lasiantha* from Mt Clarence, collected on 15 July 1838, MEL 1536084.
27. An oversight, as he is mentioned elsewhere in Sturt's (1849) account. Nevertheless, Sturt's lack of knowledge of the working men of his party is discussed by Beale (1979) in a revealing analysis of his character.

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[In cases where authorship has been shown to be different from that given under the title, the published version has not been changed as authorship here has a purely bibliograhic function.]

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Appendix

Differences in pagination in the 1838 and 1839 editions of Major T. L. Mitchell's *Three expeditions to the interior of eastern Australia*

Within a year of the publication of Major Thomas Mitchell's (1838) journals of his 1831–1832, 1835 and 1836 expeditions, a revised edition (Mitchell 1839a) of the two volumes was produced. *Opinions of the press*, a fascicle of eight pages inserted at the commencement of the second edition in the library of the Botanic Gardens of Adelaide, attests to the popularity with which Mitchell's narratives may have been received. For example:

> The ability, perseverance, and zeal of Major Mitchell, whose toils, dangers, and privations were of the most trying kind, eminently justify the choice of such a man for a service of so much peril and importance ... There is no attempt at fine writing throughout these valuable pages. The descriptions are all simple, brief, and unembellished. But the matter contained in the volumes is full of interest, of a kind, too, so close and multifarious, that we could not hope to do justice to it by extracts. The scientific details are also of considerable utility, and have been arranged with great care by some distinguished friends, to whose assistance the author bears testimony in his preface. A variety of lithographs of scenes taken on the spot, diagrams, and plates illustrative of different features of natural history, increase the value of the work, which is one of the most amusing, as well as instructive, books that has been issued for many seasons from our prolific press. (*Atlas*, 15 Sept. 1838)
>
> Major Mitchell's work on the survey of interior Australia is the most important reference to that country that has issued from the press . . . (*Morning Herald*, 12 Sept.)

The first volume and a summary and illustrations from the second volume were translated into Italian (Mitchell 1844). Little of the formal botany was included. A copy is located in the Mitchell Library.

Herbaria generally have one or other English edition but not both. Even the library at the Royal Botanic Gardens, Kew has only the second edition, together with the first volume of the first edition. Bentham (1863–1878) only had a second edition while compiling his *Flora australiensis* at Kew. The second edition was chosen by the State Library of South Australia (Mitchell 1839b) for its facsimile production.

A comparison of the two editions has shown substantial discrepancies in the pagination, which arose more through complete resetting of the type than any substantial modifications to the text. It is therefore important that these discrepancies be published to ensure correct citation.

There is also in existence a proof copy of the first edition in the Barr Smith Library, University of Adelaide (Eichler 1965). Mitchell distributed proof copies to at least some of the scientists who supplied material for the book (e.g. letter from W. Ogilvy dated 10 August 1838, return of proof corrections: *Mitchell papers* vol. III, 1830–1839 A292, pp. 454–457, Mitchell Library).

Of the 76 names appearing in the first edition of the work, 50 appear on different pages in the second. Apart from *Eucalyptus lachrymosa* (note b below), no further species were added in the second edition. All but two *Acacia* species were listed in 'A systematical list of the new plants described in this work' at the front of the first volume of the first edition; they were inserted in the second edition. The pagination of the protologues of all new names appearing in either edition is listed below.

Apart from Mitchell's *Eucarya murrayana* and *Eucalyptus lachrymosa* all species are formally named and described in Latin in a footnote to the accompanying text. Lindley is clearly cited as their author, although he attributed one name to Allan Cunningham. The published journals are largely a lightly edited version of Mitchell's diaries, housed in the Mitchell Library. Mitchell's textual references to plants were sometimes taken directly from his diaries (see Table below). More usually, however, they have been interpolated within the transcript from the diaries. Undoubtedly much information for these botanical insertions came from Lindley, but it remains to be discovered whether associated field books exist from which information written by Mitchell or his plant collector(s) could have come. There is in our experience too little information on the specimen labels for them to have been used in the insertions. Lindley's footnotes in the two editions show no differences, apart from the correction of one typographical error (Table below, note i), and an insertion by Mitchell on the flowering of *Roepera aurantiaca* at Chiswick. However, possibly in response to criticism of his style, Mitchell made many minor modifications of the text for the second edition, including those parts dealing with plants; these changes largely involved improvements in punctuation and syntax.

The publication date of the first edition was 1838, as cited on the title pages of all four first editions seen. This date is also handwritten in pencil in the second edition at Kew. It is likely that it appeared between 18 August 1838, the date of the Preface, and 1 September

1838, when the first of many reviews in the above-mentioned fascicle *Opinions of the press* appeared (ten were dated September). At least three copies were distributed before 28 August, when Sir George Murray, the former Governor of New South Wales Sir Richard Bourke, and a former military associate, Sir J. P. Hopkins thanked Mitchell for the copies he presented them (Foster 1985; *Mitchell papers* vol. III *1830–1839* A292, pp. 465–474, Mitchell Library). Bourke received his on the previous evening. On 17 August Mitchell indicated to W. Ogilvy (letter from latter of same date, in *Mitchell papers*, l.c. pp. 459–461) that the book was forthcoming. As Murray in particular is likely to have received the book immediately it was produced the likely publication date is 27 August 1838.

New species in the two editions of T. L. Mitchell's (1838, 1839a,b) *Three expeditions to the interior of eastern Australia*, with their pagination and current name, followed by notes on orthography and nomenclatural status where questionable

FAMILY Species name and author citation, spelt and punctuated as in portion of protologue in the footnotes	Volume and page number* 1st edn	2nd edn	Mention in field diary?	Note	Current scientific name
DILLENIACEAE					
Pleurandra incana, (Lindl.MSS.)	2,156	ditto	no	—	*Hibbertia ?riparia* (R. Br. ex DC.) Hoogl.
PITTOSPORACEAE					
Campylanthera ericoides, (Lindl.MS)	2,275	2,277	no	a	*Billardiera procumbens* (Hook.) E. Bennett
TREMANDRACEAE					
Tetratheca ciliata, (Lindl.MSS.)	2,205	2,206	no	—	*Tetratheca ciliata* Lindley
MYRTACEAE					
Baeckea crassifolia, (Lindl.MSS.)	2,114	2,115	no	—	*Baeckea crassifolia* Lindley
Baeckea alpina, (Lindl.MSS.)	2,177	2,178	no	—	*Baeckea ramosissima* A Cunn. *s. lat.*
Baeckea calycina, (Lindl.MSS.)	2,189	2,190	(yes)	—	*Thryptomene calycina* (Lindley) Stapf
Eucalyptus alpina, (Lindl.MSS.)	2,175	ditto	no	—	*Eucalyptus alpina* Lindley
Eucalyptus lachrymosa	absent	1,342	no	b	Unknown
Genetyllis alpestris, (Lindl.MSS.)	2,178	ditto	no	—	*Calytrix alpestris* (Lindley) Court
LORANTHACEAE					
Loranthus Quandang, (Lindl.MSS.)	2,69	ditto	no	c	*Amyema quandang* (Lindley) Tieghem
CAPPARIDACEAE					CAPPARACEAE
Capparis Mitchellii, (Lindl.MSS.)	1,311; also 1,284	1,315; also 1,287; 1,61	yes yes	—	*Capparis mitchellii* Lindley
VIOLACEAE					
Pigea floribunda, (Lindl.MSS.)	2,164	2,165	no	—	*Hybanthus floribundus* (Lindley) F. Muell.
MALVACEAE					
Hibiscus (*Trionum*) *tridactylites*, (Lindl. MS)	1,85	ditto	no	—	*Hibiscus trionum* L. var. *vesicarius* (Cav.) Hochr.
Sida corrugata, (Lindl.MSS.)	2,12	2,13	no	—	*Sida corrugata* Lindley
Sida fibulifera, (Lindl.MSS.)	2,45	ditto	?yes	—	*Sida fibulifera* Lindley
EUPHORBIACEAE					GYROSTEMONACEAE
Gyrostemon pungens, (Lindl.MSS)	2,120	2,121	yes	d	*Codonocarpus cotinifolius* (Desf.) F. Muell.
RHAMNACEAE					
Cryptandra tomentosa, (Lindl.MSS)	2,177	2,178	no	—	*Cryptandra tomentosa* Lindley
RUTACEAE					
Correa leucoclada, (Lindl.MSS.)	2,39	ditto	no	—	*Correa glabra* Lindley *s. lat.*
Correa cordifolia, (Lindl.MSS.)	2,231	2,233	no	—	*Correa reflexa* (Labill.) Vent.
Correa glabra, (Lindl.MSS.)	2,48	ditto	no	—	*Correa glabra* Lindley
Correa rotundifolia, (Lindl.MSS.)	2,217	2,219	no	—	*Correa alba* Andrews var. *pannosa* Paul G. Wilson
Eriostemon pungens, (Lindl.MSS.)	2,156	ditto	no	—	*Eriostemon pungens* Lindley
Phebalium bilobum, (Lindl.MSS.)	2,177	2,178	no	—	*Phebalium bilobum* Lindley
Didimeria aemula, (Lindl.MSS.)	2,197	2,198	no	e	*Correa aemula* (Lindley) F. Muell.
ZYGOPHYLLACEAE					
Röpera aurantiaca, (Lindl.MSS.)	2,70	ditto	yes	f	*Zygophyllum aurantiacum* (Lindley) F. Muell.
GERANIACEAE					
Pelargonium Rodneyanum, (Lindl.MSS.)	2,143	2,144	no	g	*Pelargonium rodneyanum* T. L. Mitchell ex Lindley
LEGUMINOSAE PAPILIONACEAE					
Trigonella suavissima, (Lindl.MSS.)	1,253; also 2,65	1,255; also 2,65	yes yes	—	*Trigonella suavissima* Lindley
Psoralea patens, Lindl.MSS.	2,8	2,9	no	—	*Psoralea patens* Lindley
Psoralea tenax, (Lindl.MSS.)	2,9	2,10	no	—	*Psoralea tenax* Lindley
Psoralea cinerea, (Lindl.MSS.)	2,66	2,65[sic]	yes	h	*Psoralea cinerea* Lindley
Indigofera acanthoscarpa, (Lindley. MSS)	2,17	ditto	no	i	*Glycyrrhiza acanthocarpa* (Lindley) J. Black
Daviesia pectinata, (Lindl.MSS.)	2,150	2,151	no	—	*Daviesia pectinata* Lindley
Daviesia brevifolia, (Lindl.MSS.)	2,200	2,201	no	—	*Daviesia brevifolia* Lindley
Pultenaea montana, (Lindl.MSS.)	2,178	ditto	no	—	*Pultenaea scabra* R. Br. var. *montana* (Lindley) Benth.
Pultenaea mollis, (Lindl.MSS.)	2,258	2,260	no	—	*Pultenaea mollis* Lindley
Bossiaea rosmarinifolia, (Lindl.MSS.)	2,178	ditto	no	—	*Bossiaea rosmarinifolia* Lindley
Dillwynia hispida, (Lindl.MSS.)	2,249	2,251	no	—	*Dillwynia hispida* Lindley

FAMILY Species name and author citation, spelt and punctuated as in portion of protologue in the footnotes	Volume and page number* 1st edn	Volume and page number* 2nd edn	Mention in field diary?	Note	Current scientific name
LEGUMINOSAE CAESALPINEAE					
Cassia teretifolia, (Cunninghm.MSS.)	1,286	1,289	yes	—	*Cassia artemesioides* Gaudich.
Cassia heteroloba, (Lindl.MSS.)	2,121	2,122	no	j	*Cassia nemophila* A. Cunn. ex Vogel
LEGUMINOSAE MIMOSEAE					
Acacia leucophylla, Lindl.MSS.	2,12	2,13	(no)	k	*Acacia pendula* A. Cunn.
Acacia salicina, Lindl.MSS.	2,20	ditto	no	—	*Acacia salicina* Lindley
Acacia farinosa, (Lindl.MSS.)	2,145	2,146	no	—	*Acacia farinosa* Lindley
Acacia strigosa (Lindl.MSS.)	2,184	2,185	no	—	*Acacia aspera* Lindley
Acacia exudans, (Lindl.MSS.)	2,212	2,214	no	—	*Acacia vernicifiua* A. Cunn.
Acacia furcifera, (Lindl.MSS.)	2,265	2,267	yes	—	*Acacia paradoxa* DC.
Acacia acinacea, (Lindl.MSS.)	2,265; also 2,145	2,267; also 2,146	no no	—	*Acacia acinacea* Lindley
Acacia sclerophylla, (Lindl.MSS).	2,138	2,139	no	l	*Acacia sclerophylla* Lindley
Acacia aspera, (Lindl.MSS.)	2,138	2,139	no	l	*Acacia aspera* Lindley
AMARANTHACEAE					
Trichinium alopecuroideum, Lindl.MSS.	2,12	2,13	no	—	*Ptilotus polystachyus* (Gaudich.) F. Muell.
Trichinium parviflorum, Lindl.MSS.	2,12	2,13	no	—	*Ptilotus obovatus* (Gaudich.) F. Muell. var. *parviflorus* (Lindley) Benl
Trichinium sessilifolium, Lindl.MSS.	2,12	2,13	no	—	*Ptilotus obovatus* (Gaudich.) F. Muell.
Trichinium nobile, (Lindl.MSS.)	2,23	2,22[sic]	no	—	*Ptilotus nobilis* (Lindley) F. Muell.
Trichinium lanatum, (Lindl.MSS.)	2,122	2,123	no	—	*Ptilotus obovatus* (Gaudich.) F. Muell.
CHENOPODIACEAE					
Atriplex halimoides, (Lindl.MSS.)	1,282	1,285	no	—	*Atriplex lindleyi* Moq.
Sclerolaena bicornis, (Lindl.MSS.)	2,47	ditto	no	—	*Sclerolaena bicornis* Lindley
SANTALACEAE					
Eucarya Murrayana (mihi)	2,100; also 2,121,132, 2,135; pl.36	ditto; 2,122,133, 2,137; pl.28	yes no yes	m	*Santalum murrayanum* (T. L. Mitchell) C. Gardner
[*Fusanus acuminatus*]	2,69;	ditto; also 2,137	yes yes	n	[*Santalum acuminatum* (R. Br.) A. DC.]
PROTEACEAE					
Grevillea Aquifolium, (Lindl.MSS.) (propria)	2,178	ditto	no	—	*Grevillea aquifolium* Lindley
Grevillea variabilis, (Lindl.MSS.) (propria)	2,178	2,179	no	—	*Grevillea aquifolium* Lindley
Grevillea alpina, (Lindl.MSS.) (Ptychocarpa)	2,178	2,179	no	—	*Grevillea alpina* Lindley
EPACRIDACEAE					
Leucopogon cordifolius, (Lindl.MSS.)	2,121	2,122	no	—	*Leucopogon cordifolius* Lindley
Leucopogon glacialis, (Lindl.MSS.)	2,174	2,175	no	—	*Leucopogon glacialis* Lindley
Leucopogon rufus, (Lindl.MSS.)	2,178	2,179	no	—	*Leucopogon rufus* Lindley
Epacris tomentosa, (Lindl.MSS.)	2,177	ditto	no	—	*Epacris impressa* Labill. *s. lat.*
CAPRIFOLIACEAE					
Tripetelus astralasicus (n.gen. et sp.) Lindl. MSS.	2,14	ditto	no	—	*Sambucus australasica* (Lindley) Fritsch
SOLANACEAE					
Solanum esuriale, Lindl.MSS.	2,43	ditto	yes	—	*Solanum esuriale* Lindley
Solanum ferocissimum, (Lindl.MSS.)	2,58	ditto	no	—	*Solanum ferocissimum* Lindley
CICHORACEAE					COMPOSITAE
Picris barbarorum ['Dr Lindley has favoured me with the following description']	2,344; also 2,148	 2,149	yes yes	o	*Picris squarrosa* Steetz *s.lat.*
AMARYLLIDACEAE					
Calostemma candidum, (Lindl.MS.)	1,54 & 2,30	ditto	yes no	p	*Calostemma luteum* Sims
Calostemma carneum, (Lindl.MSS.)	2,39	ditto; also 2,42	yes yes	—	*Calostemma purpureum* R. Br.
LILIACEAE					
Bulbine suavis ['Dr. Lindley, who describes it thus']	2,270	2,272	yes	q	*Bulbine glauca* (Raf.) E. M. Watson
JUNCACEAE					
Xerotes typhina Lindl.MSS.	2,41	ditto; also 2,42	yes yes	—	*Lomandra leucocephala* (R. Br.) Ewart ssp. *robusta* A. Lee
Xerotes effusa, Lindl.MSS.	2,101	ditto	yes	—	*Lomandra effusa* (Lindley) Ewart

FAMILY Species name and author citation, spelt and punctuated as in portion of protologue in the footnotes	Volume and page number* 1st edn	2nd edn	Mention in field diary?	Note	Current scientific name
GRAMINACEAE					GRAMINEAE
Panicum laevinode, (Lindl.Mss.)	1,235; also 1,287	1,238; also 1,290	yes yes	—	*Panicum decompositum* R. Br.
Danthonia lappacea, Lindl.MSS.	1,309	1,313	no	—	*Astrebla lappacea* (Lindley) Domin
Danthonia pectinata, Lindl.MSS.	2,26	ditto	no	—	*Astrebla pectinata* (Lindley) F. Muell.
Danthonia eriantha, (Lindl.MSS.)	2,304	2,307	no	r	*Danthonia eriantha* Lindley
Glensine marginata, Lindl.MSS.	1,315	ditto	no	s	*Eleusine indica* (L.) Gaertner

* The first page number given is that which is considered to constitute the principal portion of the protologue, the other just being a cross-referenced brief entry by Mitchell; in the one instance where the ampersand is used, both pages appear to be as important.

Notes

a. In the footnote, Lindley referred it to two genera which he presumably considered to be synonymous: 'This has been ascertained to be a new species of the genus Campylanthera of Hooker, or Pronaya of Baron von Hugel . . .', but in the following diagnosis he makes a definite choice of generic name with: '*Campylanthera ericoides* (Lindl.MS); erecta fruticosa . . .'. This combination appears also in the 'Systematical list of the new plants described . . .' at the front of the first volume in both editions.

b. This name only appears in the second edition under the illustration, presumably by Mitchell, of a tree on the last page of the account of the 1835 expedition. The illustration appears without caption in the first edition. The name has no author citation. In the absence of any reference to the name in the botanical literature, we consider it to have been supplied by Mitchell. Since there appears to be no associated textual description, the name must be considered invalidly published. The tree looks remarkably like *Acacia pendula*! The possibility that it was meant to be '*Eucarya lachrymosa*' also arises (cf. note m)!

c. Eichler (1965) discovered the spelling of the epithet as '*Quandangus*' in a Barr-Smith Library, University of Adelaide copy of the first edition which he considered to be a proof (see discussion in text).
Mitchell left a long line in his diary where the notes on *Loranthus Quandang* were inserted in the published journal. Does this indicate the existence of a separate field book with such notes on the plants, or was it simply space for the name to be provided by his collector or botanists later examining the collection?

d. The synonymy follows Bentham (1870). George (1982) has not dealt with Lindley's name.

e. In both editions the genus is spelt '*Didimeria*' in Lindley's footnote, but '*Didymeria*' in the list of new plants. The latter spelling has been taken up in synonymy under *Correa* by Bentham (1863). However, Wilson (1961) in his revision of *Correa*, Airy Shaw (1973) and J. J. Swart in *Index nominum genericorum* (Farr *et al.* 1979) cite the former as correct, with the latter as an orthographic variant. Since the name presumably relates to the 4-merous flowers (twice twice-parted) this seems a reasonable interpretation.

f. This name appears to have been published, probably by a matter of weeks, earlier in August 1838 than Mitchell's (1838) first edition in Lindley's (1838) *Miscellaneous notes* appended to *Edwards's botanical register*. Despite the lack of a Latin diagnosis, which Lindley provided in these notes whenever publishing a new species, and the reference to the source of the name as 'Lindley in Major Mitchell's Australia, ined.', there is no doubt that, in the absence of any reference to the name being provisional on publication in Mitchell's work, the brief but reasonably detailed description in the earlier work satisfies requirements for valid publication of the name.
Added to the footnote in Mitchell's second edition is a note dated November, 1838 on the cultivation to flowering of the plant at Chiswick.

g. Because the horticultural knowledge of Richardson could have enabled him to identify this genus, even if Mitchell's could not, it is reasonable that Mitchell actually did what he said in the field, as implied,: 'We also discovered a beautiful new species of the Cape genus *Pelargonium* ... I named it *P. Rodneyanum* ...'. The usual author citation of 'T. L. Mitchell ex Lindley' is therefore correct in acknowledging the only certain contributor to the name. There is no reference to the plant in his diary. It is possible that this name came about at a later stage through the series of name changes surrounding '*Victoria lachrymia*' (p. 64).

h. Unless the proofs of Mitchell's first edition constitute effective publication, the available evidence indicates that this name was first published in Lindley's (1838) *Miscellaneous notes* issued with the monthly parts of *Edwards's botanical register* in August 1838. As in note f above, there is no Latin description and the species is similarly referred to Lindley's authorship in Mitchell's work, but the description is sufficient to satisfy valid publication of the name in the earlier work.

i. The genus name was not spelt out in the journal proper, both in the text reference 'an indigo' and in the footnote. However, '*Indigofera*' appears in the 'Systematical list of new plants', which forms part of the protologue.
Furthermore, in Lindley's diagnosis appears '*acanthoscarpa*', while the 'List' has '*acanthocarpa*'. In the second edition the name in the footnote was altered to '*acantho carpa*', the '*s*' being removed but the space so formed remaining. There is no doubt that '*acanthoscarpa* is a typographic error which is best corrected, although even the changes made to the newest *Code* do not at present make it mandatory.

j. Mitchell in the text: 'If new, I would name it *C. heteroloba*'. It is possible that he discussed this name with Richardson, as he did the names of topographic features with his men (see Stapylton's diary in Andrews 1986). The author citation of the species should be 'T. L. Mitchell ex Lindley'. There is no mention of this plant, let alone the name, in Mitchell's diary.

k. *Acacia pendula* is referred to by name often in Mitchell's diary.

l. These two Acacias do not appear in the list of new species, but occur, as in the second edition, at the end of chapter 6 of volume 2.

m. In the list of new plants at the beginning of the first volume the genus name is questioned: '?*Eucarya Murrayana*', but under the figure the name appears in full without question, nor is there any other indication of doubt in the accompanying text. The query may indicate that Mitchell had been given cause by Lindley or Brown to doubt the distinctiveness of his new genus. It may have linked with Brown's genus *Fusanus* which oddly follows in the list of novelties. See the section dealing with Mitchell's expeditions (p. 64) for the background to Mitchell's naming of this plant, and the tardy acceptance of the name by the botanical community.

n. This name was published much earlier by Brown (1810b) in his *Prodromus*, and yet included in Mitchell's list of new plants. See section on Mitchell's expeditions (p. 64) for Lindley's initial recognition of this as a new genus.

o. This diagnosis and that of *Bulbine suavis* (note q) are identical to those appearing in the *Miscellaneous notes* of August 1838 and June 1838 accompanying the respective monthly issues of *Edwards's botanical register*. The discourse on the *Picris* was received by Mitchell on 17 July 1838 (Mitchell 1838), possibly in the form of a proof of the *Miscellaneous notes*. The text, possibly in the form of proofs, of Mitchell's first

edition, presumably containing Lindley's other diagnoses, had already been seen by Lindley, for in the *Miscellaneous notes* he refers to *Picris barbarorum* as what is mentioned by Major Mitchell at p. 148 of the second volume of his work on Australia, as having been found by him par-boiled, as a food of the natives.

As has been recognized by previous authors (e.g. Cooke 1986; Watson 1987), the original place of publication of the two names is in the *Miscellaneous notes*.

p. Lindley has provided two complementary Latin diagnoses which appear as footnotes on the two pages cited. Contrary to Telford's (1987) citation, the protologue encompasses both pages, not just the first, from which there is in any case a cross-reference to the second.

q. Not the original place of publication. See Note o.

r. This species is referred to in the list of new plants in the first edition as occurring on page 320 of volume 2, but neither the name nor a description are located there.

s. *Glensine* appears only in Lindley's footnote in the first edition. It is clearly an error for *Eleusine*, a genus named and described by Gaertner in 1788. The latter correct spelling appears in the list of new plants in the same edition. The error was corrected in the second edition.

Early impressions of the vegetation of the Sydney region: exploration and plant use by the First Fleet Officers

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Abstract

There was no official naturalist assigned to the First Fleet; this is surprising given the tradition of having scientists along on voyages of exploration and given also the support of Sir Joseph Banks for the establishment of a colony in New South Wales. Perhaps the work done on Cook's voyages was considered an adequate base for the establishment of a settlement or possibly the Surgeons were expected to fill this role as well as their medical one? The first written impressions of the vegetation of the Sydney region come, in fact, from Governor Phillip himself and from a number of the senior Naval and Military Officers. In this paper some of their descriptions of the country, of the local vegetation and of individual plants are examined and their use of available food plants and timber trees noted. An attempt is made to assess the value of their writings for the ecological and botanical history of the region.

The first written observations of the Sydney-Port Jackson region come from the Commander (Governor Arthur Phillip) and officers of the First Fleet — men such as John Hunter, Captain of the *Sirius* and William Bradley, his First Lieutenant; the Surgeons John White, George Worgan and Arthur Bowes Smyth; the Captain of the Marines, Watkin Tench, and the Judge-Advocate, David Collins. They were all well-educated men and keen observers; their writings and illustrations provide us with a wealth of information, albeit of a general nature, on the type of country they found, the soils and vegetation, the availability of food and medicinal plants and the use the aborigines made of various plants.

Hunter and Bradley were expert surveyors and cartographers — they provided detailed comment on the waterways and adjoining countryside and on the habits of the Aborigines they observed. Hunter's published journal (1793) has engravings from his own drawings, including several of natural history subjects; and a bound volume of watercolour sketches held by the National Library of Australia includes paintings of plants, birds, fish, other marine organisms and of Aborigines (Whitehead 1988). Bradley's manuscript journal (1786–1792), published as a facsimile in 1969, includes a number of watercolour plates and charts.

John White was a keen naturalist and collected many of the 'non-descript productions' of the strange land, sending them back to Thomas Wilson in England. A number of these were used as the basis for descriptions and illustrations by J. E. Smith (1793–1795). Arthur Bowes Smyth also collected plants and animals and did some sketches, while Watkin Tench collected soil samples and precise meteorological data (according to Fitzhardinge 1979, editor of Tench's *Narrative* and *Complete Account*). George Worgan, one of the more eccentric of the group (known to have taken a piano to Botany Bay aboard the *Sirius*), provides interesting comment on daily activities as well as on landscape, vegetation and the Aborigines in his journal (Worgan 1788). Other natural history artists associated with the First Fleet and the settlement at Port Jackson are discussed by Whitehead (1988).

Botany Bay to Sydney Cove

The First Fleet officers were no doubt very thankful to have arrived in Botany Bay after an eight-month voyage with 'a fleet of eleven sail, nine of which were merchantmen that had never before sailed in that distant and imperfectly explored ocean' (Collins 1798, 1802 p. 1). But now they had to find suitable land for the settlement and to establish a viable colony. They had as background the journals of Cook and Banks, both of whom had recommended Botany Bay. Phillip, however, on examining it soon after arrival, realized it was unsuitable for the settlement of over 1,000 people on account of the land being very swampy and the Bay shallow and exposed to the easterly winds, so he set off to examine Port Jackson and Broken Bay — both named but not entered by Cook.

Hunter, who accompanied Phillip, said of the entrance to Port Jackson that 'the outer heads or capes that form its entrance . . . are high, rugged and perpendicular cliffs' (Fig. 1). They entered the harbour and 'proceeded up for two days, examining every cove . . . the country was also particularly noticed and found greatly superior in every respect to that around Botany-bay' (Hunter 1793, p. 29). Phillip (in Historical Records of New South Wales 1892, p. 122) reported his choice of cove as

> the one that had the best spring of water, and in which the ships can anchor so close to the shore that at a very small expence quays may be made at which the largest ships may unload . . . (Fig. 2).

The explorers returned to Botany Bay and prepared to move all the ships round to Port Jackson.

Bowes Smyth, Surgeon on the *Lady Penrhyn* which remained in Botany Bay, noted for 22 January 1788 that 'I went on shore and stayed all day collecting nat-

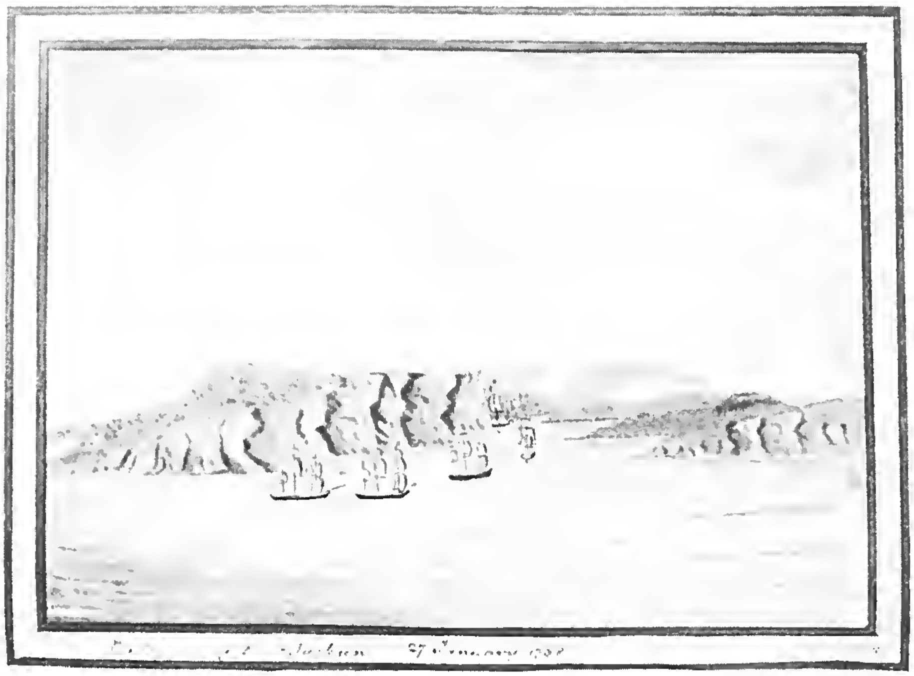

Fig. 1. Entrance of Port Jackson, 27 January 1788 — William Bradley watercolour.

Fig. 2. Sydney Cove, Port Jackson 1788 — William Bradley watercolour.

ural productions.' Of the north side of the Bay, visited the day before, he said:

> there are great numbers of very large and lofty trees reaching almost to the waters edge and every vacant spot between the trees appears to be covered with verdure. But upon a closer inspection, the grass is found long and coarse, the trees very large and in general hollow, and the wood itself fit for no purpose of building or anything but the fire. The soil to a great depth is nothing but a black sand.

And of the south side 'there are many cabbage trees, but scarce any fruit whatever'. Having wandered some distance into the woods he became lost and 'at one time I was surrounded by fern (exactly the same as in England) on every side above my head' (Bowes Smyth 1787–89, pp. 57–60).

Bradley's chart (Chart 9, op. cit.) of Botany Bay shows 'swampy and barren' land west of Pt Solander (i.e. south of Weeney Bay), 'sandy and swampy' west of Cooks River, and 'sandy and barren country' north of Bare Island. Hunter (op. cit., p. 52), returning overland from a visit to the French ships in Botany Bay in March said of the country between Sydney and Botany Bay:

> [we] travelled through the woods and swamps, of which there were many on our route (in a direct line eight or nine miles) . . . the country about two miles to the southward of Port Jackson abounds with high trees and little or no underwood; but between that and Botany Bay, it is all thick, low woods or scrubberies, barren heaths and swamps; the land near the sea, although covered in many places with wood, is rocky from the water-side to the very summit of the hills . . .

Sydney Cove and Port Jackson

On arrival at Port Jackson attention focussed on setting up camp, but within a few days further detailed exploration of the harbour was undertaken by Hunter and Bradley in particular, and the land near to Sydney

Fig. 3. First interview with the native women at Port Jackson, New South Wales — William Bradley watercolour.

Fig. 4. A view of the upper part of Port Jackson, when the fish was shot — William Bradley watercolour.

Cove was explored. Phillip (op. cit., p. 127) reported that Port Jackson contained

> a considerable number of coves, formed by narrow necks of land, mostly rocks covered with timber, and the face of the country, when viewed from the harbour, is the same, with few exceptions. The neck of land between the harbour and the coast is mostly sand.

Bradley's sketch of the entrance to Port Jackson (Fig. 1) shows low vegetation on the North and South Head areas with taller woodland further inland to the south. Of North Head Bradley (op. cit., p. 109) noted: 'the land about the N Head is sandy ground between the tops of the rocks, covered with a variety of brushwood and shrubs some of which have very pretty blossoms'.

Worgan (op. cit., p. 7) mentioned the forested nature of Sydney Harbour shores:

> the land forms a number of pleasant coves in most of which 6 or 7 ships may lie secured to the trees on shore. It contains likewise a number of small islands which are covered with trees and a variety of herbage all of which appears to be evergreen.

Bradley's watercolour, *First interview with the native women at Port Jackson*, shows tall trees, relatively dense almost to the beach edge, and a very dense bushy understorey (Fig. 3). This meeting was in Manly Cove.

Bradley also discussed and portrayed the harbour above Farm Cove. He (Bradley op. cit., p. 75) said: 'Those coves above where the ships lay were surrounded by mangroves and had mudflats at the bottom, those below had sandy beaches most of them.' And 'about four mile higher than where the ships lay, the country was open and improved the farther we went up and in most places not any underwood, grass very long' (Bradley op. cit., p. 75). His view, the *Upper part of Port Jackson: when the fish was shot*, shows relatively dense stands of trees above a rocky foreshore, but with grassy understorey, and in the distance a low dense, darker green shrubby fringe — possibly

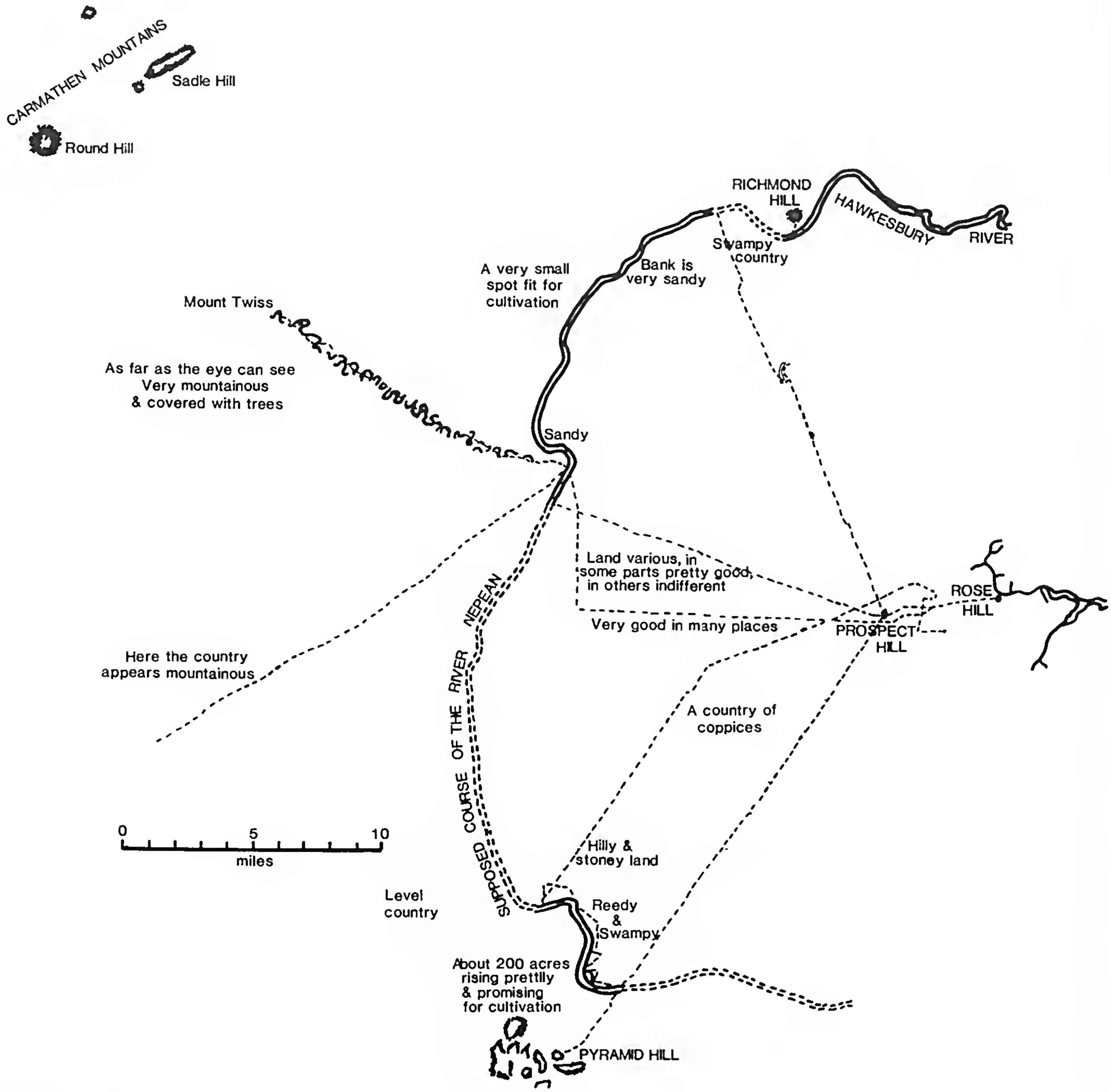

Fig. 5. Exploration routes and comments on the country — Rose Hill to the Carmathen Mountains.

mangroves (Fig. 4). The site of this painting has been suggested to be Supply Head, now Manns Point at Greenwich (Kennedy & Kennedy 1982). Bradley's chart (Chart 11) of the *Channel to Rose Hill* shows Homebush Bay with the creek on the southeast side noted as 'full of mangroves, not room for boat oars', and the upper reaches of the Duck River as 'full of stumps and fallen trees.'

Exploration

A number of exploratory expeditions were undertaken within the first few months and within 18 months the country for a radius of about 100 kms had been traversed, the Hawkesbury River and the Nepean River had been found and also a few areas of land suitable for cultivation. The range of country the explorers travelled through on their expedition west from the head of Port Jackson included 'a thicket of brushwood, which we found so impervious as to oblige us to return nearly to the place from whence we had set out in the morning' to river banks where 'the grass was tolerably rich and succulent, and in height nearly up to the middle, interspersed with a plant much resembling the indigo' to other areas where the river banks 'were now pleasant, the trees immensely large, and at a considerable distance from each other; and the land around us flat and rather low, but well covered with the kind of grass just mentioned' (White op. cit., pp. 127–128). In this area they found a 'quarry of slates' — presumably Wianamatta shales.

The exploration of the northern shores of the harbour, north and west from Manly Cove to somewhere north of Pennant Hills was through rather more difficult country. There were 'thickets and swamps', 'immense woods' and high, rocky country, 'the soil arid, parched and inhospitable'. Near Pennant Hills they came to rather better country — White said 'the land here, although covered with an endless wood, was

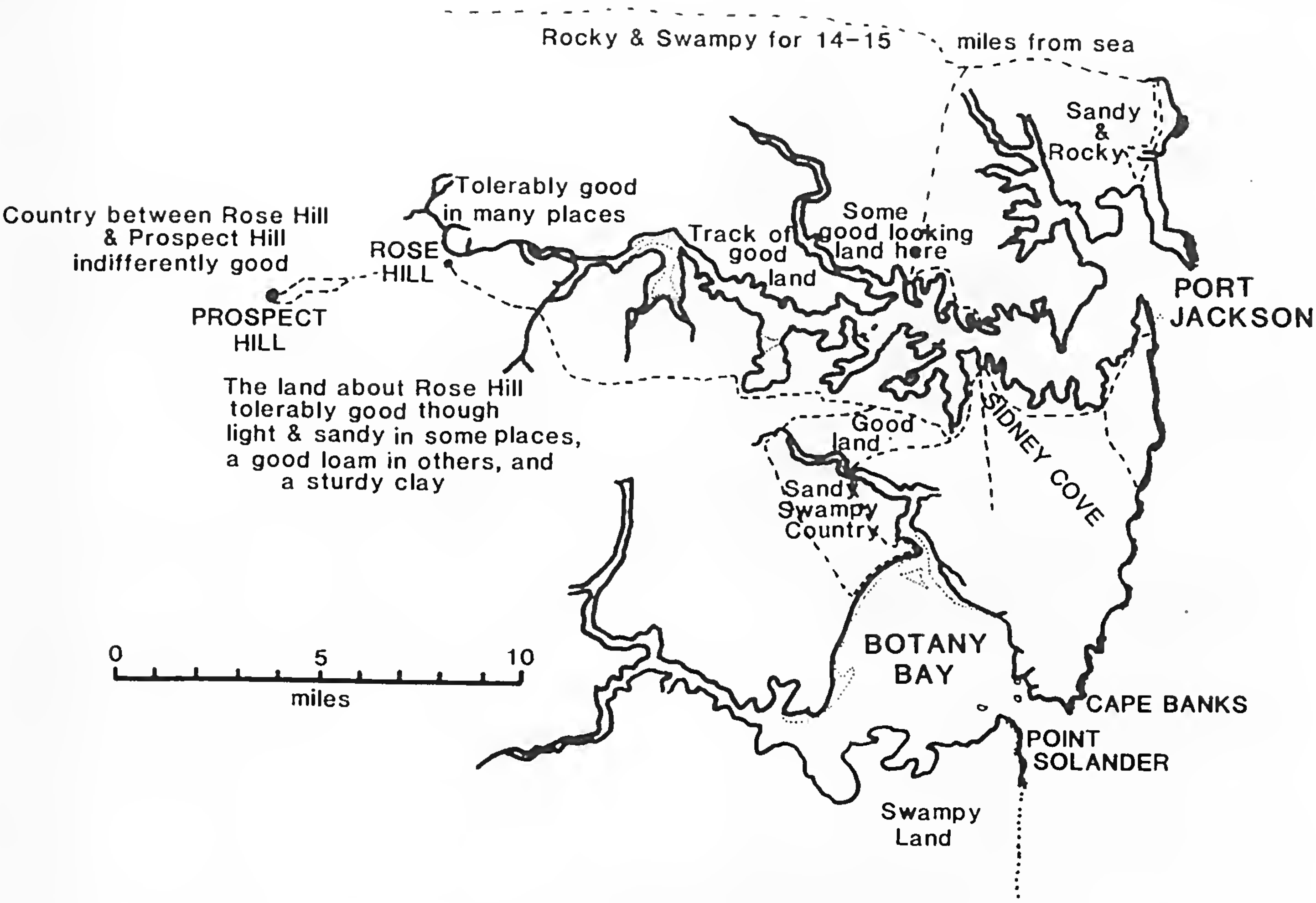

Fig. 6. Exploration routes and comments on the country — Port Jackson to Botany Bay.

better than the parts which we had already explored. Finding it, however, very unlikely that we should be able to penetrate through this immense forest, and circumstanced as we were, it was thought more prudent to return.' (White op. cit., pp. 121–125). Phillip (op. cit., p. 133) said of the same trip:

> The country we passed thro' when we left the low grounds was the most rocky and barren I ever saw; the ascending and descending of the mountains being practicable only in particular places, but covered with flowering shrubs . . .

On most if not all of these expeditions plants and animals were collected for preservation and forwarding to natural history experts in England. White (op. cit., p. 158) mentioned that, returning from Broken Bay along the sea coast, they 'picked up, in the distance of about half a mile, twenty-five flowers of plants and shrubs of different genera and species'. Figures 5–7, based on Dawes map of 1791, indicate the extent of the exploration and the types of comments on the landscape made within the first 18 months or so of settlement.

While the observations are basically geographical and ecological, together with the maps and charts available they do provide a basis for reconstruction of the broad vegetation types. Such attempts have been made by Campbell (1924, assisted by J. H. Maiden) for the Sydney Cove settlement area, and by Kartzoff (1969) and Burrell (1972) for the Sydney region more generally. Maps have recently been produced by Dodson (1987) and modified somewhat by Aplin (1988). In all cases they suggest the presence of open forest and woodlands with mixed eucalypt species present on Sydney sandstone areas, including *Eucalyptus pilularis* (blackbutt), *E. piperita* (Sydney peppermint) and *Angophora costata* (smooth-barked apple) on the sheltered slopes and in gullies, and *E. haemastoma* (scribbly gum), *E. gummifera* (*red bloodwood*) and *E. oblonga* (narrow-leaved stringybark) on the drier, more exposed ridges and plateaux. Open and closed heathlands were present on the coastal headlands and clifftops and blackbutt-blue gum forests (*E. pilularis — E. saligna*) on the clay-rich soils of the Wianamatta Shales in moderate to high rainfall areas. Grey box and forest red gum woodlands (*E. moluccana* and *E. tereticornis*) were found west of Parramatta (D. Benson, pers. comm.). Small patches of rainforest occurred in the sheltered coastal gullies and mangroves, saltmarshes and she-oak (*Allocasuarina*) woodlands or brackish- and fresh-water swamps occupied the littoral alluvial flats.

A striking feature of many of the descriptions is the open nature of the country, with widely spaced very large trees and little or no understorey, only a grassy ground cover of kangaroo grass, *Themeda australis*, or in some areas blady grass, *Imperata cylindrica*, or ferns (almost certainly bracken, *Pteridium esculentum*, as mentioned by Bowes Smyth). The numerous comments on fires, initially thought to be caused by lightning but soon attributed to the Aborigines, must be considered in relation to this. The lack of understorey and the type of ground cover in many of the forested areas was probably due to the frequency and type of

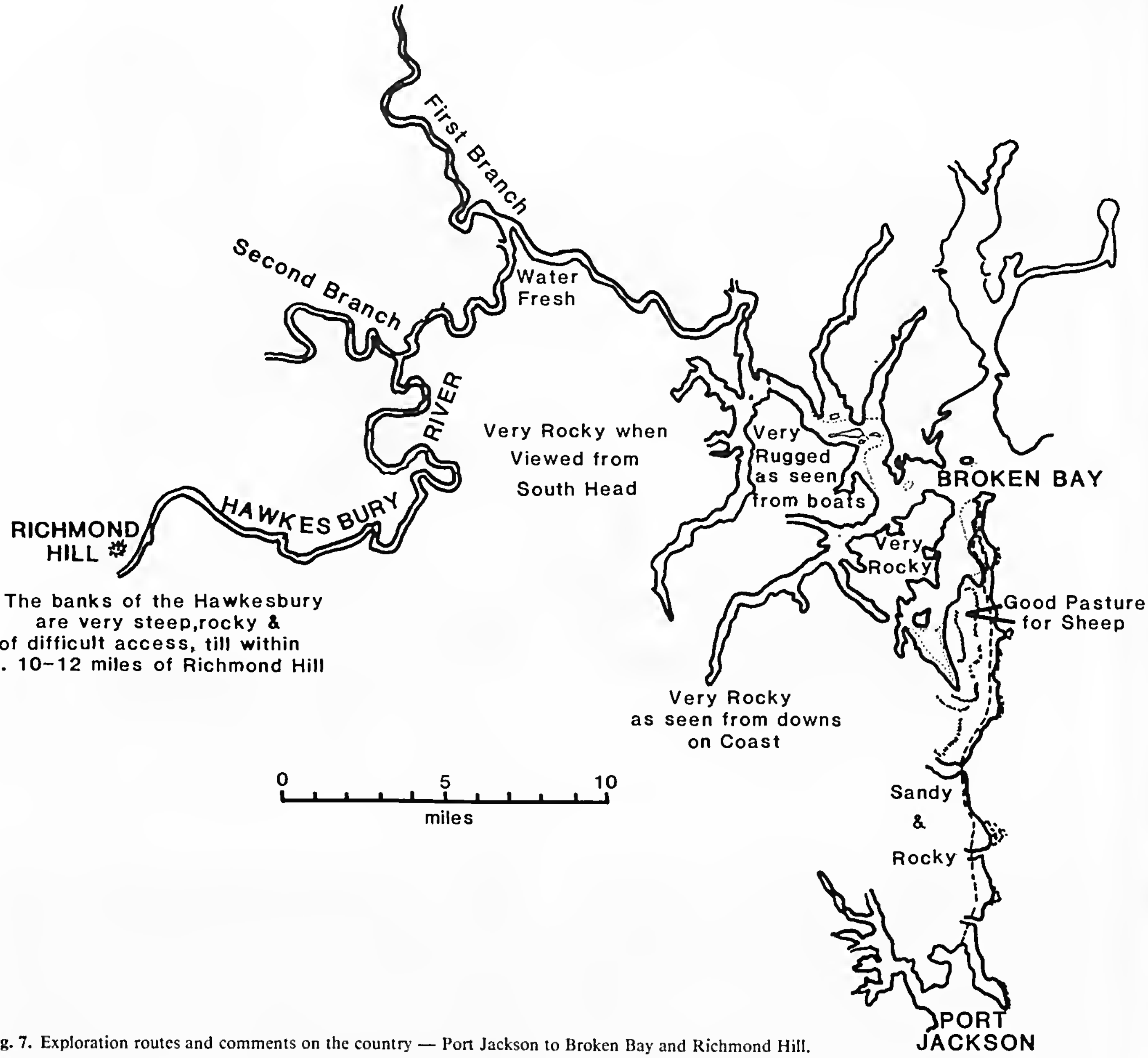

Fig. 7. Exploration routes and comments on the country — Port Jackson to Broken Bay and Richmond Hill.

burning done by the Aborigines. Hunter (op. cit., p. 43) said: 'They also, when in considerable numbers, set the country on fire for several miles extent'. Phillip (op. cit., p.135) commented that:

> In all the country thro' which I have passed I have seldom gone a quarter of a mile without seeing trees which appear to have been destroyed by fire . . . the natives always make their fire, if not before their own huts, at the root of a gum-tree, which burns very freely, and they never put a fire out when they leave the place.

White (op. cit., p. 130) and companions, while on the Prospect Hill expedition,

> saw a hollow tree on fire . . . On coming near, and minutely examining it, we found that it had been set on fire by the natives; for there was some dry grass lighted and put into the hole . . .

Not only were the forested areas burned, but also the heathlands. Hunter mentions visiting a fire lit by Aborigines near North Head in July. He (Hunter op. cit., p. 55) wrote:

> there were not less than three or four acres of ground all in a blaze . . . We had observed that they generally took the advantage of windy weather for making such fires, which would of course occasion their spreading over a greater extent of ground.

The reasons conjectured for the use of fire by Aborigines included: driving out animals from the bush so they could be easily killed, and clearing the 'brush or underwood' to make travelling easier or, in winter, the digging up of orchid roots (observed by Hunter).

The grassy cover appears to relate mainly to the clay soils of the Wianamatta Shales, a shrubby understorey being more commonly developed on the Hawkesbury Sandstone areas (D. Benson, pers.comm.). With the arrival of the European almost certainly fire frequency changed, and consequent upon that, the composition and density of the understorey and undergrowth of many of the forested areas and also the floristics of other plant communities.

Plant use

Concurrent with the exploration, land was being cleared, local timber was being cut for buildings, and local foods and medicines were being sought to supplement the rations and to help treat the scurvy and dysentery that was present in the early days of the settlement.

The lack of an official botanist, horticulturalist or scientifically trained naturalist assigned to the First Fleet is rather surprising given the tradition of having naturalists along on voyages of exploration and also given that it was primarily Banks who had suggested the suitability of Botany Bay for settlement. The First Fleet was sent out to establish a settlement and was under the control of the government and the military, and although it was recognized that further exploration would be necessary it may have been considered that Cook's voyages had laid an adequate botanical foundation for the start of a settlement. Gilbert (1981) in noting the lack of an official naturalist with the First Fleet considers it may have been because Banks wanted to give the colony time to establish itself successfully. But he suggests also, that it may have been due to an oversight, or lack of success on Bank's part.

Whatever the reason for such an omission, the lack of a botanist was very strongly felt in the early days of the settlement, and commented upon by most of the officers. Phillip (op. cit., p. 128), writing to Lord Sydney on 15 May 1788, said:

> I must beg leave to observe, with regret, that being myself without the smallest knowledge of botany, I am without one botanist, or even an intelligent gardener, in the colony . . .. which has such a variety of plants that I cannot, with all my ignorance, help being convinced that it merits the attention of a naturalist and the botanist.

Tench (1789, 1793, p. 66) said:

> Nor can I help being . . . concerned, that an experienced botanist was not sent out, for the purpose of collecting and describing the rare and beautiful plants with which the country abounds . . .Indeed, we flattered ourselves, when at the Cape of Good Hope, that Mason, the King's botanical gardener, who was employed there in collecting for the royal nursery at Kew, would have joined us, but it seems his orders and engagements prevented him from quitting that beaten track, to enter on this scene of novelty and variety . . . To the naturalists this country holds out many invitations.

Banks did have the Governor and many of the Officers collecting for him, however, as evidenced by their letters and journals (e.g. Phillip op. cit., p. 128; White op. cit., appendix 1) as well as the first Colonial Chaplain, Reverend Richard Johnson. Later, in 1791, he employed David Burton, the superintendent of convicts to collect and send both living and dried botanical specimens to him (Gilbert 1981). Banks is credited with 76 introduced Australian species in *Hortus Kewensis* for the years 1781–1800 and these came mainly from New South Wales (Carter 1988).

Hunter (op. cit., p. 49) said:

> The vast variety of beautiful plants and flowers, which are to be found in this country, may hereafter afford much entertainment to the curious in the science of botany; but I am wholly unqualified to describe the different sorts with which we find the woods to abound; we sometimes met with a little wild spinach, parsley and sorrel, but in too small quantities to expect it to be of any advantage to the seamen.

Food and medicinal plants

Only very few native plants were gathered by the First Fleeters and not surprisingly they were ones that appeared similar to those used back in England, or were known to have been used by Cook on his voyages.

The parsley and sorrel mentioned by Hunter were probably *Apium prostratum* and *Oxalis corniculata* or wood sorrel. There are two forms of *Apium*, one found on the swamp margins, the other on open sand dunes. It was used by Cook as an anti-scorbutic; also eaten by Labillardiére — and named and described by him from Tasmania. The wood sorrel is mentioned also by White (op. cit., p. 137) who gathered it en route from Botany Bay to Sydney. The spinach was almost certainly *Tetragonia tetragonioides* — New Zealand spinach (native also of Japan, S. America and Australia) common in coastal districts growing on the sand. The young shoots taste like English spinach. It was used by Captain Cook who is said 'to have had it served out to the sailors every day, at breakfast and dinner' (Woolls 1867, p. 26).

Other possible food plants were tried on the exploratory expeditions: White (op. cit., p. 157) mentions gathering some beans, possibly *Canavalia* as they grew on the beach foredune. He said:

> They were well tasted, and very similar to the English long-pod bean . . . we had them boiled, and we all eat very heartily of them. Half an hour after, the governor and I were seized with a violent vomiting . . .

Fruits used occasionally included raspberries (*Rubus* spp.) collected en route to Broken Bay (White, op. cit., p. 158), lilly pilly (*Acmena smithii*) or 'the small purple apple mentioned by Cook' (Tench op. cit., p. 65), wild figs (particularly *Ficus rubiginosa*) which the Aborigines demonstrated were edible (White op. cit., p. 153), and were also used by Cook (Maiden, 1909) but considered 'nascous' by later settlers (Mann 1811, p. 50) as was the native cherry, *Exocarpos cupressiformis*. The common appleberry or dumpling, *Billardiera scandens* was used also (described by J. E. Smith (1793–1795) on the basis of specimens sent to him by White).

White (op. cit., p. 155) in discussing scurvy said:

> that disorder still prevails . . ., nor can we at present find any remedy against it, notwithstanding that the country produces several sorts of plants and shrubs which, in this place, are considered as tolerable vegetables, and used in common. The most plentiful is a plant growing on the seashore, greatly resembling sage. Among it are often to be found samphire, and a kind of wild spinage, besides a small shrub which we distinguish by the name of the vegetable tree, and the leaves of which prove rather a pleasant substitute for vegetables.

The sage was probably grey saltbush, *Atriplex cinerea*, a seashore shrub with edible leaves similar in appearance to the English sage, *Salvia officinalis*, although unrelated to it. Mann (1811, p. 51) wrote 'Botany Bay greens are procured in abundance; they much resemble sage in appearance and are esteemed a very good dish by the Europeans, but despised by the natives.'

The samphire was probably *Sarcocornia quinqueflora*, a small salt marsh herb similar to the English samphire which was used as a pickle. The young shoots when cooked taste like a salty spinach (Cribb & Cribb 1974, p. 128). Also probably used was the seablite, *Suaeda australis* (syn *S. maritima* var. *australis*), a sandflat and salt marsh plant often found associated with samphire; the leafy stem tips can be eaten raw or

cooked or pickled, and taste like salty beans (Cribb & Cribb 1974, p. 130). The 'vegetable tree' of White is impossible to identify but may have been a species of *Hibiscus* as many of them have edible leaves and are widely used in the Pacific, Melanesia through to Asia.

Other plants observed to be used as food by the Aborigines but not added to the European settlers diet included fern and orchid roots (noted by Bradley and Hunter to be roasted or broiled before being eaten), and some 'wild yams about the size of a walnut' observed on the banks of the Macdonald and Hawkesbury rivers (Hunter, op. cit., pp. 102, 104). Bracken (*Pteridium esculentum*) and swamp waterfern (*Blechnum indicum*) were probably used and species of *Caladenia*, *Diuris* and *Gastrodia* among the orchids. The wild yams may have been *Microseris lanceolata* (Murnong), *Leichhardtia leptophylla* (syn. *Marsdenia leptophylla*, bush bananas) or possibly *Cyperus* or *Typha* species.

Others, such as the cycad, burrawang (*Macrozamia communis*) required considerable preparation to make them edible and Bradley (op. cit., p. 135) reported that 'one of the convicts was poisoned by eating them, . . . in what manner the natives prepare them I do not know but I tasted some at Broken Bay and thought them good.'

Two plants mentioned in most of the journals as being effective against scurvy were the sweet tea, *Smilax glyciphylla* (also known as native sarsaparilla), and the native currant, *Leptomeria acida*. Sweet tea was described by White (op. cit., p. 155) as

> a creeping kind of vine, running to a great extent along the ground; the stalk is not so thick as the smallest honeysuckle; nor is the leaf so large as the common bay leaf, though something similar to it; and the taste is sweet, exactly like the liquorice root of the shops. Of this the convicts and soldiers make an infusion which is tolerably pleasant, and serves as no bad succedaneum for tea . . . In using it for medicinal purposes, I have found it to be a good pectoral, and . . . not at all unpleasant.

This species, a member of the Smilacaceae, is widespread in damp situations and wet sclerophyll vegetation. Maiden (in Campbell 1924) considers it would have been available in Sydney Cove. Analysis of the fruit indicated a vitamin C content of 21 milligrams per 100 grams i.e. more or less equivalent to tomatoes (Davey et al. 1947).

The native currant was also described by White (op. cit., p. 155):

> We have also a kind of shrub . . . resembling the common broom, which produces a small berry like a white currant, but in taste more similar to a very sour green gooseberry. This has proved a good antiscorbutic; but I am sorry to add that the quantity to be met with is far from sufficient to remove the scurvy.

Tench (op. cit., p. 65) mentioned this also: 'a fruit which has the appearance of a grape though in taste more like a green gooseberry, being excessively sour.' This is a large shrub, widespread in dry sclerophyll forest and in sheltered situations. A member of the Santalaceae, the fruit has 26 milligrams of vitamin C per 100 grams (Davey et al. 1947). Mann, writing in 1811 of Port Jackson said that 'Native green currants grow wildly, and make an uncommonly fine jelly' (Mann 1811, p. 50).

Species used as medicines included *Xanthorrhoea* sp. (grass tree), *Eucalyptus piperita* (Sydney peppermint or peppermint tree) and possibly *E. resinifera* (red mahogany). Arthur Bowes Smyth (op. cit., p. 70) wrote of the *Xanthorrhoea*:

> collected a large quantity of yellow Balsam from a tree, or rather a shrub which grows in great numbers on the sandy hills near Botany Bay . . . there is no doubt of this Balsam possessing medicinal virtues as it has been repeatedly made use of . . . in pulmonary disorders and with success. It dissolves perfectly in spirits and is of a most fragrant and aromatic taste and smell — I have etched the likeness of the tree which produces this gum, with my pen which I have subjoined and is no very bad resemblance of it.

The oil of the peppermint tree, was found to be effective in treating 'all cholicky complaints'. It was so-named 'on account of the very great resemblance between the essential oil drawn from its leaves and that obtained from the peppermint (*Mentha piperita*) which grows in England'. A quart of this oil was sent by White to Thomas Wilson for analysis (White op. cit., p. 173–4).

White considered the 'astringent red gum', (collected possibly from a number of species of *Eucalyptus*, not just *E. resinifera*) was more powerful medicinally than the yellow *Xanthorrhoea* resin. He (White op. cit., p. 145) said 'I have found [it] very serviceable in an obstinate dysentery that raged at our first landing'.

A multi-purpose plant

One species that was found to be valuable not only as food but also for building purposes was *Livistona australis*, the cabbage palm. White (op. cit., p. 156), camping on the way to Broken Bay from Manly Cove (in June 1788) near a cabbage tree swamp, recorded that 'the whole party got as much cabbage to eat with their salt provisions [and with a 'fine duck' that they shot], as they chose.' Thus the 'heart cabbage' was eaten raw or cooked, the outer part of the stem, moderately hard, was used for slabs for buildings, the inner pith was used as food for the pigs, and the leaves and later the fibre of the leaves were used in the manufacture of hats.

Timber

Clearance of the land began almost immediately after arrival at Sydney Cove. Worgan (op. cit., p. 33) noted on 27 January 1788:

> Early this morning a number of the Artificers and Convicts were sent on shore with the necessary implements for clearing the ground felling trees, in order that the tents might be pitched for the Battalion. . .

The Sydney sandstone open forest and woodland eucalypts and angophoras were the first trees to be cut down by the convicts when they established a saw-pit at Botany Bay. One can imagine their reaction to the exceedingly hard, gum-filled timber that they attempted to cut into planks but that split and warped when used green. Almost all of the officers comment on it. White (op. cit., p. 119) said:

> the timber of this country is very unfit for the purpose of building. Nor do I know any one purpose for which it will answer except for fire-wood; and for that it is excellent: but in other respects it is the worst wood that any country or climate ever produced, altho' some of the trees, when standing, appear fit for any use whatever, masts for shipping not excepted.

Hunter (op. cit., p. 49) recorded:

> we were here in the middle of a wood, in which were trees from the size of a man's arm to 28 feet in circumference; but were either so very crooked, so rent, or so very rotten in the heart, that we could scarcely get one sound or serviceable in a dozen; and what in our situation was a very great misfortune, we had not as yet found one piece of timber that would float on water . . .

Collins (1798, 1802) said in early March, 1788:

> the long-boats of the ships in the cove were employed in bringing up cabbage-tree from the lower part of the harbour, where it grew in great abundance and was found, when cut into proper lengths, very fit for the purpose of erecting temporary huts, the posts and plates of which being made from the pine of this country [*Casuarina* spp.], and the sides and ends filled with lengths of the cabbage tree, plastered over with clay, formed a very good hovel.

Phillip (op. cit., p. 128) noted that 'The timber which in its growth resembles the fir-tree warps less, but we are already obliged to fetch it from some distance, and it will not float.' He was referring to *Casuarina* spp. that were found to be suitable for roofing shingles as well as for frames and floors.

A short time later they found timber trees of higher quality on the Wianamatta shales and in the forests along the Hawkesbury River. In early 1791 Bradley wrote of the value of some 12 species used for house and boat building, for furniture and for tools and wheels etc. These possibly included *Eucalyptus paniculata*, *E. piperita*, *E. robusta*, *E. pilularis* and *E. saligna* amongst the eucalypts, and *Syncarpia glomulifera* (turpentine), *Ceratopetalum apetalum* (coachwood), *Casuarina* spp. and *Banksia* spp. amongst others. His list does not include *Toona australis*, the Australian red cedar, which was to be exported in large quantities within a few years.

Conclusions

The material selected for discussion above is only a very small part of that present in the journals of the First Fleet Officers but it does indicate the type of information available and the richness of the source. These journals, with their vivid descriptions, natural history drawings,landscape paintings and etchings, and accurate charts are the only source of information we have on the vegetation and landscape of the Sydney region at the time of European settlement. Even by 1789 there is a reduction in the written observations and fewer paintings and maps are extant. Exploration turned to areas further afield, the local environment was more familiar and food shortages were becoming critical and claiming more attention from those in charge. By the time George Caley and Allan Cunningham arrived (in 1800 and 1816 respectively) to take a more professionally scientific interest in the country, much of the immediate Sydney vegetation had been cleared and the effects of Aboriginal burning and other subsistence practices had diminished as a result of lower population numbers and movement away from the region. As Gilbert (1981, p. 223) says

> The first instruments used in the botanical investigation of New South Wales were the axe, the saw and the hoe, and there has been a strong propensity for destroying trees ever since.

Given this, the written observations of the First Fleet Officers should not be underestimated as a source of ecological and botanical information.

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William Baeuerlen — a 'circumspect and zealous' collector

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Abstract

Wilhelm Bäuerlen (anglicized as William Baeuerlen) was born in Germany in 1840. His early career is unknown. He first came to notice as an independent collector of plant materials in the 1880s, collecting in SE New South Wales and NE Victoria under contract to F. Mueller at the Botanic Gardens, Melbourne, and later J. H. Maiden at the Technological Museum, Sydney. Bäuerlen was botanical collector on the 1885 *Bonito* expedition to southern New Guinea. He was official full-time Collector to the Technological Museum (now the Museum of Applied Arts and Sciences) 1890–1905, collecting all manner of plant samples, particularly in the NE, SE and NW of New South Wales. Maiden, Baker and Smith made substantial use of his collections in their taxonomic and chemical studies of *Acacia*, *Eucalyptus* and *Callitris*. His numerous herbarium specimens (now in NSW) from the NE of the State form the only substantial botanical record of the 'Big Scrub' rainforest, long since mostly cleared. Numerous new taxa have been described from his specimens, at least 20 of them named in his honour.

In the National Herbarium of New South Wales (NSW), William Bäuerlen's name is to be found as collector of many of the early specimens from the north-east and south-east of that state. Indeed, his herbarium specimens from north-eastern New South Wales are the only substantial botanical record of the 'Big Scrub', that extensive rainforest of which only small pockets remain. In the National Herbarium of Victoria (MEL) his name occurs often on specimens collected in the extreme north-east of Victoria and south-west of Papua New Guinea. His numerous collections contributed significantly to the taxonomic and chemical work of J. H. Maiden, R. T. Baker and H. G. Smith on *Acacia* Mill., *Eucalyptus* L'Hérit. and *Callitris* Vent.

But who was this collector? Steenis-Kruseman (1950) and Hall (1978) gave the sketchy biographical information available to them. I have been able to add considerably to this, although there are still gaps, notably relating to his early life and his life after retirement. Bäuerlen's collecting activities have been pieced together from references in publications (mainly by Mueller, Maiden and Baker), from annual reports and archival material at the Museum of Applied Arts and Sciences, Sydney (MAAS), formerly known as the Technological Museum, and from his specimens and letters in NSW and MEL.[1]

Early life

William or Wilhelm Bäuerlen was born on 27 October 1840 at Niedernhall, Germany (Bürgermeister of Neidernhall, *in litt.* May 1988). He was the third child of Carl Friedrich Theodor Bäuerlen (1809–1857), who was probably a paper-manufacturer, and his wife Johanne Theresie (née Becker) (1805–1844). Little is known about his early life. He was only four years old when his mother died, just five months after the birth of her fourth child (who also died the following month). Wilhelm's father died when Wilhelm was 16, and he was then placed in an orphanage in nearby Stuttgart.

Bäuerlen probably had little contact with family members after this time. For example, he misquoted his father's name as 'Carl Rudolf' when he married in 1896, and seems to have consistently referred to himself as 'Leonhard (or Leonard) Carl Wilhelm', despite having been named Leonhardt Wilhelm Carl at birth. In Australia, he usually anglicized his name to William (although when writing in German, as to Mueller, he signed himself Wilhelm) but kept his surname intact in its accented German form. The correct anglicized form is of course Baeuerlen (Adams 1980). However, others frequently altered his surname to Bauerlen, Bauerlin, Baurerlen, Barlan and, the final indignity, to Banerlin on his death certificate.

His path to becoming William Bäuerlen, botanical collector, is undocumented. However, J. H. Maiden referred to him as being a 'trained collector of Economic Botany specimens'[2] and his writings also indicate that he was both well-educated and botanically knowledgeable. Watson's reminiscences (1921) refer to him as having had 'good technical training'. Bäuerlen's scientific expertise extended to the pioneering field of electricity, on which he gave public lectures and demonstrations at Nowra. He was described in Nowra's weekly newspaper as 'the locally well known botanist and electrician' and as 'a man who observed things as they *are*' [their italics].[3] He also mentioned in a letter to Maiden the possibility of personally carrying out further chemical analyses, using his own spectroscope, if sufficient material was available of the gums and resins he had been collecting for the Museum.[4] When preparing to go to the north-east in 1890, he referred in a letter to Maiden to selling some of his (unspecified) 'scientific apparatus'[5].

Bäuerlen left Niedernhall on 27 July 1863 to emigrate to Australia (Bürgermeister of Niedernhall, *in*

litt. May 1988). His date of arrival in Australia has not been traced, but he was sending specimens to Ferdinand Mueller in Melbourne at least by September 1883. He based himself in the Shoalhaven area (Nowra–Cambewarra), collecting intensively there, at least partly on contract for Mueller (Mueller 1885: 197), and extending to the Braidwood area on the Southern Tablelands (Table 1). He was not postmaster at Bombala in the 1880s as suggested by Adams & Williams (1988).

***Bonito* expedition to New Guinea**

On the recommendation of Mueller, he was appointed botanical collector to the *Bonito* expedition to British New Guinea (Papua), on a salary of 15 pounds per month.[6] This expedition was organized by the New South Wales branch of the fledgling Royal Geographical Society of Australasia (of which Sir Edward Strickland was President and J. H. Maiden was honorary Secretary) with support from the Victorian branch and funded by the New South Wales, Victorian and Queensland Governments. Its original purpose was to explore the Aird River region of southern New Guinea, using the steam launch *Bonito*, which left Sydney on 10 June 1885, and returned 3 December 1885 (Fig. 1). Another member of the expedition was W. W. Froggatt, later Government Entomologist in New South Wales. The expedition's progress and supposed massacre were widely reported.[7]

At the last moment, the expedition's target had to be changed to the more westerly Fly River, on the basis of local knowledge gained at Cooktown, Queensland. The party spent four months exploring the Fly and its tributary, the Strickland River, which they named and explored for about 210 km upstream from its junction with the Fly. Numerous natural history collections were made. However, the relatively few taxonomic novelties and the lack of a full and unified report on the expedition's finds meant that its scientific impact was limited. Of the zoological specimens, the entomological were considered the most significant (Macleay 1886, Ramsay 1888). About 1,000 botanical specimens were sent to Mueller for naming (Anon. 1896) but he published on about only 5% of them, mainly in his incomplete series 'Descriptive Notes on Papuan Plants'. The tenth and final part of the series, as fore-

Fig. 1. Members of the *Bonito* expedition to Papua 1885. Photographed 8 December 1885 at Watsons Bay. *Back row (from left)*: W. W. Froggatt (zoological collector and entomologist), S. A. Bernays (surgeon and botanist), A. J. Vogan (artist and explorer), P. Waddick (seaman and explorer). *Middle row (from left)*: W. Bäuerlen (botanical collector), G. E. Hemsworth (nautical sub-leader), Capt. H. C. Everill (Leader), J. W. Haacke (chief scientist: zoology and geology). *Front row (from left)*: R. G. Creagh (land sub-leader), J. H. Shaw (photographer and explorer). Designations are those given by Everill (1888: 172). Reproduced, with kind permission, from the original photograph in the Mitchell Library, State Library of New South Wales.

shadowed by Mueller (1890a), was to be devoted to collections made by Bäuerlen and another New Guinea collector, H. O. Forbes, but was never published. A few of the specimens were used by other botanists, for example, Candolle (1903), but many have remained essentially unconsulted in MEL.

For Bäuerlen, the *Bonito* expedition led to an address, delivered 'with an accuracy and vigour remarkable for a foreigner', to the Shoalhaven Agricultural Association.[8] The address was subsequently printed as the first of his only two known publications (Bäuerlen 1886). More importantly for his career, the expedition brought him in contact with Joseph Henry Maiden, who was then Curator of the new Technological Museum in Sydney (now the Museum of Applied Arts and Sciences).

Back in the Shoalhaven area, Bäuerlen not only resumed collecting specimens for Mueller (Mueller 1888a) but, from about July 1886, was also collecting for the Technological Museum in Sydney. He collected widely in the south-east corner of New South Wales and the extreme north-east of Victoria (Maiden 1887), also visiting the far north-west of New South Wales in 1887 (Mueller 1888b, 1888c) and the Snowy Mountains in early 1890 (Fig. 2).[9]

He was appointed on 31 March 1887 as an agent (Bevollmächtigter) of the Museum für Völkerkunde (Ethnological Museum) in Leipzig (B. Scheps, *in litt.* June 1988). The basis of this appointment is unknown but it was possibly instigated by F. Mueller, or may have been based on early work of which no record has been found. The association was apparently not fruitful: the Museum has no record of ever receiving any plant specimens from him.[8] Bäuerlen was reported as being a Fellow of the Ethnological Society (the Völkerkundliche Gesellschaft) of Leipzig.[10] However, he was never listed as a member of that now-defunct society (B. Scheps (*in litt.*)

Collecting pattern

As explained by Maiden[2], the usual arrangement was for Bäuerlen to collect in an area for at least a few months, making day trips on foot from his lodgings, and using regular coach, train and steamer services to move between areas. At one period he bought a horse and trap[11], which gave him greater flexibility. He collected all 'vegetable products' and associated herbarium vouchers for the Technological Museum with emphasis on potential economic products, occasionally adding a few mineral samples and even aboriginal tools.[12] His letters sometimes mention collecting insects for W. W. Froggatt, particularly those associated with eucalypts.[13] He occasionally arranged with local people to collect for him — with mixed success.[14]

His specimens

No complete listing exists of Bäuerlen's plant collections (timber, gums, etc. as well as herbarium specimens). At least 70 species and infraspecific taxa have been described from his herbarium specimens, mostly by Mueller, Maiden and Baker. About 20 of those taxa are named after him, often misspelt as 'bauerlenii'. As prescribed by Article 73.6 of the International Code of Botanical Nomenclature (Greuter *et al.* 1988), the correct spelling is 'baeuerlenii', as in *Correa baeuerlenii* F. Muell.

Most herbarium specimens collected before 1890, including his New Guinea collections, were sent directly to Mueller in Melbourne. Those of his specimens that survived in the Technological Museum were

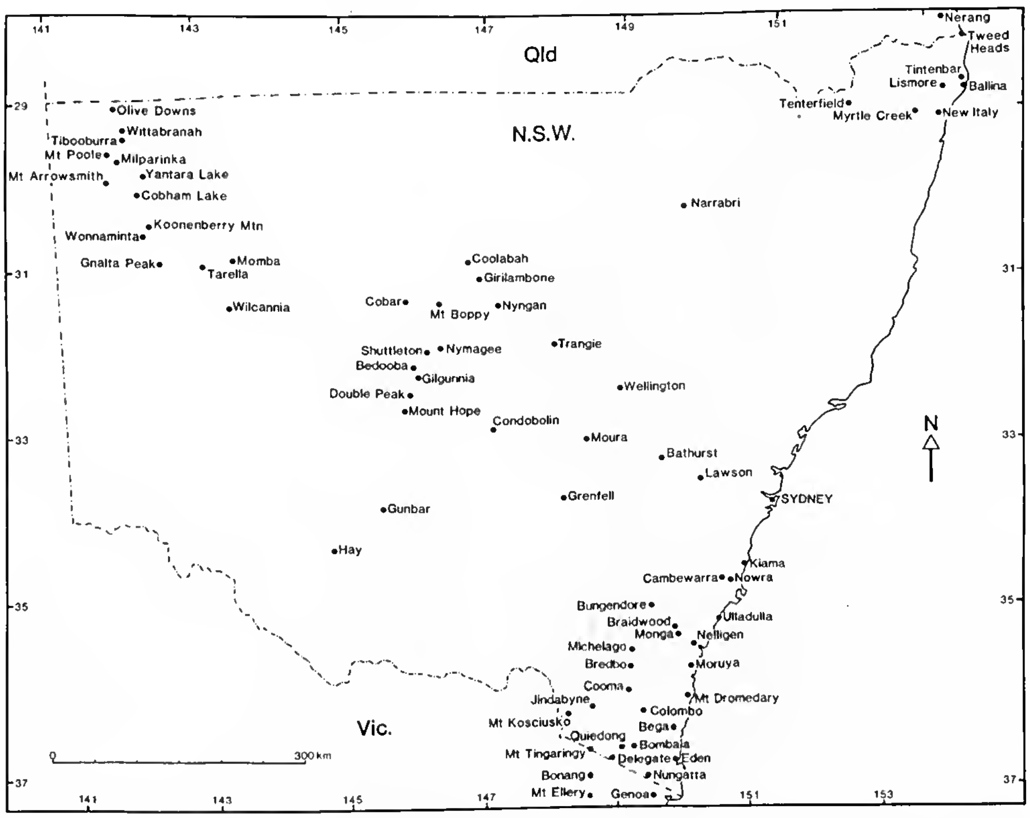

Fig. 2. Areas of New South Wales, Victoria and Queensland in which Bäuerlen collected. Not all of his collecting localities are shown; a detailed list has been lodged in the library of the Royal Botanic Gardens, Sydney, and is available from the librarian.

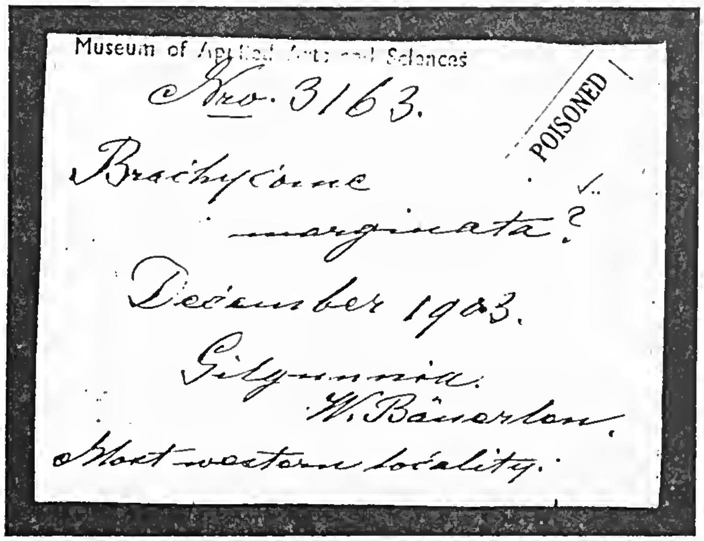

Fig. 3. A typical specimen label, for a specimen of *Brachyscome heterodonta* DC. var. *heterodonta*, in Bäuerlen's script.

transferred to NSW, with the rest of the Museum's herbarium, in 1979 when the Museum ceased to take an interest in botanical research and products. There is no accurate count but this latter material is estimated to consist of several thousand specimens. These collections are generally copious and duplicates are being distributed by NSW. Some duplicates had been sent to NSW during Maiden's period as Director of the Botanic Gardens[15] and a few also found their way into overseas herbaria, notably B, KIEL, M, and P (Lanjouw & Stafleu 1954).

Label information is generally limited to species name, locality and date (usually month and year only) (Fig. 3). Perhaps half the specimens bear a number, which is probably a species number rather than a collection number. It seems likely that he started a new number series for each fieldtrip before 1890, while he used a single series after his appointment in 1890 as Botanical Collector at the Museum. However, no fieldbooks or correspondence have been found to confirm this. Cases have been found of apparently incorrect label data, and these mostly seem to be due to mistranscription by others from his original field labels.

Bäuerlen rarely wrote any habit or habitat notes on the labels, but the Museum archives include, in the box with his letters, a large set of handwritten notes on foolscap sheets dealing with individual species. A few of these notes are filed with his specimens in NSW. In these he compared his various collections of each species. These collections were often spread over several years, indicating either a very good memory or the existence of fieldbooks that have since disappeared.

Botanical collector at the Technological Museum

Bäuerlen was appointed on 5 May 1890 to a full-time permanent position as Botanical Collector at the Museum, on a salary of 150 pounds per annum plus four shillings daily expenses, continuing in that position (and on that same salary) till his retirement in June 1905. This would seem to have been an extremely good salary in 1890, since his successor Charles F. Laseron started in 1906 on only 104 pounds per annum with a travelling allowance of 6 shillings per day (he was regarded as less experienced than Bäuerlen).[16] Bäuerlen's income was certainly such that he could afford to buy new botanical books: he refers in a letter to Maiden, dated 20 June 1887, for example, to the parts of Brown's *Forest flora of South Australia* (1882–90) that he had received.

His extant correspondence with Mueller and Maiden from the late 1880s reveals his enthusiasm for collecting. He was botanically knowledgeable and had a good eye for taxa. His field notes were often quoted in publications by Maiden and Baker (e.g. Maiden 1917, Baker 1900). He was arguing the existence of natural hybrids in the eucalypts with Mueller and Maiden for some years before those botanists had accepted the idea (Mueller 1890b, Maiden 1904).

In 1891, he published at his own expense the first and only fascicle of *The wildflowers of New South Wales* (Bäuerlen & Lovegrove 1891) with text written by him and illustrations by Gertrude Lovegrove. Subscriptions were presumably inadequate since no more of the projected 25 parts were published.

A copy of this rare work is in the Mitchell Library.[17] An account of its contents and availability is given in the *Shoalhaven Telegraph* (21 Jan. 1891). In a letter to Maiden, Bäuerlen gave extensive details of the protracted history of production of the work, thereby defending himself against a charge by Baker of acting in an untoward manner as a public servant (undertaking a project without having his superior's permission).[18] Bäuerlen stated that 250 copies were received by the authors (at a cost of 50 pounds to himself) some time in December 1890. Date of publication therefore lies somewhere between 1 December 1890 and 21 January 1891.

Probably Bäuerlen's major contribution in recording the flora of New South Wales was the extensive collection of herbarium and other specimens he made between February 1891 and June 1898 in the north-east of the state. He used Ballina and Lismore as bases but ranged from New Italy and Myrtle Creek in the south to Murwillumbah and Tweed Heads in the north, with one brief trip over the border to Nerang in Queensland. Maiden was far-sighted in sending him to that region since these specimens form the only substantial record of the flora of the 'Big Scrub', most of which has since been cleared so that only small pockets now survive of the original lush and extensive rainforest (Jervis 1958).

After his lengthy period in the north-east, Bäuerlen collected mainly samples of eucalypts and *Callitris* (up to 12 sacks of leaves per specimen!) for essential oil analysis by Richard T. Baker and Henry G. Smith (Maiden had left to become Director of the Botanic Gardens in June 1896). This work eventually led Bäuerlen to complain of being made 'the drudge for the Chemist'.[19] Bäuerlen went back to his old stamping ground around Braidwood in June 1898 and continued south to north-eastern Victoria in early 1899.[20] His later movements are summarized in Table I.

Records are vague as to his activities in 1902, but he took 43 days sick leave and 28 days recreation leave that year: his first substantial periods of leave since his appointment in 1890. In fact, Bäuerlen's leave record is remarkable by today's standards: he took no recreation leave until 1902 and no sick leave until 1897.[21]

In the spring of 1902, he was possibly collecting in north-east Victoria (J. H. Willis pers. comm.). His offi-

Table I
Known collecting areas of Bäuerlen

c. Sept. 1883-May 1885:	SE New South Wales and NE Victoria.
June-Dec. 1885:	*Bonito* expedition to Fly River, New Guinea.
Jan. 1886-July 1887:	SE N.S.W. and NE Victoria.
Aug. 1887-Jan. 1888:	NW N.S.W. (Wilcannia to Tibooburra).
Feb. 1888-Jan. 1891:	SE N.S.W. (including Mt Kosciusko).
Feb. 1891-May 1898:	NE N.S.W. (including one brief trip to Nerang, SE Queensland).
June 1898-March 1899:	SE N.S.W.
April 1899-c. Sept. 1899:	Blue Mountains and Bathurst.
c. Nov. 1899-c. April 1900:	Nyngan area.
Nov.-Dec. 1900:	Hay area.
March-April 1901:	Condobolin to Grenfell.
June-July 1901:	Narrabri.
July-Aug. 1901:	Tenterfield.
Sept. 1902:	?NE Victoria.
Nov. 1902-May 1903:	Wellington.
May 1903-April 1904:	Cobar to Mt Hope.
April 1905:	eastern suburbs of Sydney.

cial diaries start again on 11 November 1902 with his departure from Sydney by train to collect around Wellington. He went on to collect between Cobar and Mount Hope until April 1904. From mid February 1904, Baker was sending letters and telegrams ordering Bäuerlen to return to Sydney to prepare for going back to the north-east. Bäuerlen replied either insolently or not at all, but eventually obeyed orders insofar as he was back in Sydney by late May.[22]

Little detail is known of Bäuerlen's personal life. He had married Leah Charlotte Currie in Ballina on 8 June 1896, when he was 55 and she was 25, less than half his age.[23] It must have been a difficult marriage from the start. His attitude is perhaps indicated by his official diary entry for 8 June, his wedding day (the same entry as for the preceding few days): 'Collected about Ballina'. On 10 June he was off to collect at nearby Tintenbar for the rest of the week and by late June he was collecting farther north, between Mullumbimby and Tweed Heads, not returning to Ballina until 11 August. There is no hint as to whether Mrs Bäuerlen accompanied him on any trips, but it seems unlikely that someone used to travelling and collecting alone (and mostly on foot) for at least 25 years should suddenly change his habits. They apparently had a daughter Lenora, born about 1898, and it seems even more unlikely that he would have taken a wife and small child with him.[24]

By 1904, Bäuerlen's enthusiasm for collecting had obviously waned, as had also his health, and he was suffering in his personal and professional life. From the admittedly incomplete records available, this change would seem to have been either caused or exacerbated by his conflict with Baker.

Richard Thomas Baker was appointed Scientific Assistant to the Curator of the Technological Museum from 1888 and became Curator in 1898 (Hall 1978), a post he held until his retirement in 1921. He is reputed to have been a difficult person to deal with, both personally and professionally; for example, the story of the strong differences between him and Maiden over eucalypt taxonomy remains to be told. One of Bäuerlen's charges against Baker was that he had caused a significant breach in relations between staff of the Museum and Botanic Gardens.[25]

Bäuerlen obviously respected Maiden but just as obviously thoroughly disliked Baker and considered him a hindrance to botanical science in New South Wales, as well as a poor administrator. It is unlikely, however, that the problems lay solely with Baker. At the Museum Bäuerlen apparently quarrelled with or criticized the work of other staff members too. It is perhaps an indication of Bäuerlen's personality, or the difficulties under which he was working, that at this time he also quarrelled with, and became estranged from, his wife.[26]

Bäuerlen's collections were the basis for many of Baker's publications, a fact that Baker only rarely acknowledged explicitly (e.g. Baker 1900, 1902). A more handsome acknowledgment was made in the joint work on eucalypts (Baker & Smith 1902: vi). However, Baker and Smith did not mention him in their (1910) work on Australian pines, despite the *Callitris* collections he had made for this research before his retirement.

Whatever the cause, Bäuerlen's physical and/or mental health had deteriorated to the extent that he spent the second half of 1904 on recreation and sick leave, being also suspended from duty for one month for insubordination. He returned to duty in December on six months probation. Early in 1905 he was pronounced medically fit and again ordered to return to the north-east to collect but found various trifling excuses for delaying his departure.[27]

This strained period ended in his retirement on 30 June 1905, just four months before his 65th birthday.

His later years

The rather sorry tale continued over the next few years. In November 1905, he was ordered by letter to stay out of all but the public areas of the Museum, since his status was now 'that of a member of the general public'. He was also ordered not to have his mail addressed to the Museum.[28]

In 1906, he wrote to the Under Secretary of the Chief Secretary's Department, which had responsibility for the Botanic Gardens, alluding to the difficult relations between Maiden and Baker. This resulted in Maiden replying diplomatically to the Under Secretary that 'the most friendly relations have existed between the Curator of the Technological Museum and myself for some years past'. However, Maiden continued, 'there always will be differences of opinion on scientific matters'. Any sympathy he had for Bäuerlen had apparently gone since he added, rather irritably, that he objected 'to a third person endeavouring to stir up strife between two public officers'.[29]

He was recorded as a member of the New South Wales Naturalists Club in 1906 in volume 1 of their journal *Australian Naturalist*, but the list may have been out of date since it gave his address as the Museum.

Bäuerlen's final recorded involvement in botanical matters was a futile court case in September 1908, brought by him against the Under Secretary of the Department of Justice (as nominal defendant for the New South Wales Government) for the return of letters and two botanical notebooks allegedly taken from his desk in February 1905 and for monetary compensation for their detention or loss. The case was dismissed out of hand because Bäuerlen could produce no

evidence that any Government employee was responsible for their disappearance.[30]

Bäuerlen is recorded on electoral rolls and in John Sands' annual *New South Wales Directory* as continuing to live in Redfern at various addresses until his death in Sydney Hospital on 28 October 1917, the day after his 77th birthday. Cause of death was given as cerebral thrombosis (what would now be called a stroke) and septic meningitis (probably bacterial meningitis). His death certificate is a rather pathetic document. The original meagre details, with his name given as William Banerlin, were certified by the Secretary of Sydney Hospital. It was not until January 1918 that his estranged widow corrected his name and added other details, which generally corresponded with those on their marriage certificate. She obviously believed him to be younger than he really was, since she altered his age at death to 72. He was buried in an unmarked grave in the public section of the Church of England portion of Rookwood Cemetery.

Altogether, this was a rather sad end to a life that had initially been lived with such enthusiasm as to lead Mueller (1883: 151) to call him a 'circumspect and zealous' collector and Maiden and Baker (1896: 585) to refer to him as a 'painstaking botanical collector'.

Acknowledgements

Access to the archives of the Museum of Applied Arts and Sciences (MAAS) was vital in preparing this paper. I am very grateful to Vanessa Mack (Acting Registrar), Lana Das (Head Librarian) and their staff members, who were most helpful despite being busy with preparations for the opening of the Powerhouse Museum. Many of my colleagues helped in the preparation of this paper and the associated poster presented at the Melbourne symposium, whether by bringing Bäuerlen's specimens to my attention, or preparing figures and locality lists, or commenting on the manuscript. Special thanks go to Peter Richards, Bob Makinson, Emma Jefferson, Chris Kalucy, Surrey Jacobs, Barbara Briggs, Chris Dunn, Peter Weston and Peter Wilson.

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Notes

MAAS = Museum of Applied Arts and Sciences, Sydney; this institution began as the Technological Museum, changing its name in 1950.

MA = Archives of MAAS (only partially ordered and accessible to me).

CCL = MA 14/1 Letterbook: copies of official letters to the Collector 1890–1920.

CCS = MA Letterbook series: Copies of correspondence sent, series 1 (23.9.1882–14.7.1921)

OLC = box MA 114 *p.p.*: Original letters from the Collector to the Curator 1886–1901. (This box also contains Bäuerlen's diary sheets (1890–1904) and undated detailed notes on particular species collected.)

ST = the *Shoalhaven Telegraph* weekly newspaper (Nowra).

1. Bäuerlen's collecting activities: MAAS archival records: letter books (CCL, and CCS vols. 4–25 (1886–1907)), collector's letters (OLC), diary sheets (MA 114), and a book (MA 116/119) of butts of official telegrams sent 15.8.1885–14.3.1890 (mainly to Bäuerlen). Other relevant documents may possibly exist in currently inaccessible parts of MA.

His movements from 1890 as official Museum Collector are easy to trace since he was required to submit brief weekly diary sheets, most of which have survived (MA 114 *p.p.*). Their veracity, however, may be doubtful at least sometimes, e.g. the entry for his wedding day. In another case, his diary entries for 18–28 May 1898 apparently did not coincide with his claim for travelling expenses (CCS vol. 14 — letter 234).
2. Letter from Maiden 15 April 1890 to the Superintendent of the Technical Education Branch, Dept. of Public Instruction (copy ex MEL per H. H. G. McKern).
3. ST 11 August 1886, p. 2, and issue of 30 June 1886, p. 2.
4. OLC — letter of 11 April 1887 from Quiedong.
5. OLC — letter of 7 November 1890 from Cambewarra.
6. Letter book 1 (Mitchell Library A2664) of the Royal Geographical Society of Australasia (New South Wales branch) (15.4.1883–5.12.1885). See also *Trans. & Proc. Roy. Geogr. Soc. of Australasia (New South Wales Branch)* vols. 3–4: 195–164, 170–187 (1888) — details of the members of the expedition are given pp. 112–115, 172.
7. For example, in ST 19 November, 25 November and 3 December 1885.
8. ST 1 April 1886, p. 2
9. OLC — letter of 9 July 1886 from Cambewarra; CCS — letters 312, 314 from Maiden 13 April 1887 to Bäuerlen at Bombala. See also note 2.
10. ST 20 July 1887, p. 2.
11. OLC — letter of January 1889, from Browns Camp near Delegate.
12. OLC — letter of 13 May 1887 from Delegate. MAAS Annual Report 1889: 5; *op. cit.* 1895: 187.
13. OLC — letter of 20 June 1887 from Bombala.
14. OLC — letters of 23 March 1887 from Quiedong; and 4 July 1887 from Lyttleton near Colombo; CCL — letter no. 961 from Baker 14 July 1898 to Bäuerlen at Braidwood.
15. Royal Botanic Gardens, Sydney: Annual Report for 1898: 11 (1899); MAAS Annual Report 1898: 173.
16. CCS vol. 22 — letter no. 1, from Baker to the Superintendent 29 June 1905; vol. 25 — letter no. 95, 18 Jan. 1907.
17. Mitchell Library at F581.991/1.
18. OLC — letter of 27 Sept. 1891 from Ballina, with printed prospectus sheet attached.
19. CCS vol. 20 — letter nos. 228–229.
20. MAAS Annual Report 1899: 173.
21. CCS vol. 21 — letter no. 654 of 18 or 19 May 1905 from Baker to the Superintendent.
22. CCS vol. 20 — letters nos. 226–9 (20 April 1904), 798 (1 November 1904).
23. N.S.W. Registry of Births, Deaths and Marriages — marriage entry 2711 for 1896 records that Leonhard Carl Wilhelm Bäuerlen, botanist, age 47 [he was actually 55!], married Leah Charlotte Currie, age 25, in St Mary's Church of England, Ballina. She was born at Oatlands, Tasmania, 15 January 1871, the daughter of Edward Currie, an innkeeper or publican (died before June 1896), and Amelia Watts (Tasmanian Registry birth entry no.: Oatlands 1162). She survived him by many years. Her date of death is not known but she was living in the Manly area until at least 1958 according to Electoral Rolls.
24. The only record found of a child of the marriage is on Bäuerlen's death certificate (N.S.W. Death entry no. 1917–1395). Amongst the details added to this entry by Mrs Bäuerlen in 1918 was the existence of a daughter, Lenora L., then said to be aged 20. No record of her birth has been found in the indexes to the N.S.W. and Tasmanian registers.
25. CCS vol. 21 — letters nos. 9 (7.11.1904) and 577 (25.4.1905) from Baker to the Superintendent summarize Bäuerlen's complaints and charges against Baker. J. L. Willis mentions the differences between Bäuerlen and Baker in his manuscript history of MAAS, *From palace to powerhouse* (1982) — copies in MAAS Library.
26. CCS vol. 20 — letter (sheet nos. 226–229) of 20 April 1904 from Assistant Curator H. G. Smith to the Superintendent. CCS vol. 21 — letter no. 9 from Baker to the Superintendent mentions one of Bäuerlen's charges against Baker, namely Baker's alleged sympathetic reception of Mrs Bäuerlen's complaints against her husband. The date of separation of the Bäuerlens is not clear, but is probably indicated by the listing of Mrs Bäuerlen at a separate address from 1912, in the issues of the period of John Sands' *N.S.W. Directory*.
27. CCS vols. 20 and 21 — numerous letters from Baker and Smith to the Superintendent and Bäuerlen (April 1904–May 1905).
28. CCS vol. 22 — letter no. 548 from Baker to Bäuerlen 15 Nov. 1905.

29. Archives of Royal Botanic Gardens, Sydney — Confidential letterbook relating to staff 1.7.1902–10.8.1908 — Letter no. 441 from Maiden to the Under Secretary 4 August 1906.
30. *Sydney Morning Herald* 12 September 1908 p. 6, report headed 'District Court/ (Before his Honour Judge Rogers)/ Botanic specimens/ Bauerlen v. Williams'. A more colourful report is given in *The Evening News (Sydney)* 12 September 1908 p. 10, col. 3, headed 'The aggrieved botanist/ And the worried judge'.

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Retracing the route taken by Robert Brown and company in a portion of the Flinders Ranges

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On 9 March 1802, HMS *Investigator* came to anchor in Spencer Gulf, just a little south of present day Red Cliff Point. Next morning two parties prepared to leave ship for further exploration. Flinders was to take a longboat further into the gulf, while Robert Brown, his assistant Peter Good, landscape artist William Westall, botanical artist Ferdinand Bauer and three attendants, John Allen, the 'practical miner' (Vallence & Moore 1982, p.4), Brown's servant Porter, and Westall's servant White (name uncertain; Vallence, pers. comm. 1988) were to go ashore and climb mountain 'X'. This hill, on the eastern side of the Gulf, was the highest in the immediate range and Flinders later named it Mt Brown.

In his diary entry of 10 March, Brown[1] stated:

> Before 6 o'clock set off for the highest mountain in the chain which bore N by E 30° of the ship and whose base we supposed to be not more than 5 miles from the beach.

As it turned out both parties badly misjudged distance in this landscape and were to spend an uncomfortable night in a strange environment.

Brown's party came ashore on the beach just south of present day Chinaman Creek (Cooper 1955). Beyond the beach where they landed the area is boggy salt-marsh for several kilometres, and no doubt this was time-consuming to traverse. The salt water and mud would not have been a good start for feet about to undertake a long walk and then ascend a mountain range. A straight line distance of 22 km lies between the landing beach and Woolundunga at the base of the hills. Besides the difficulty of the salt-marshes a wide area of dissected alluvial fans, with a number of deep but dry creek crossings, had to be negotiated. All this had to be accomplished before the steep ascent could begin. In his journal Brown said that they reached the hills by 2 o'clock.[2] Assuming they were ashore by 7 o'clock this means that they had been walking for about seven hours.

Peter Good's diary (Edwards 1981) informs us that, almost immediately upon reaching the hills, one of the attendants was so exhausted and footsore that he was returned to an area in the creek where there were signs of water. Apparently, in the expectation that water would be acquired on the hill, no detailed investigation was made at the time of the area to which the attendant was sent. The month of March is usually the driest time of the year in this area. Unwittingly they were setting themselves up for a difficult time; their own supplies of water were limited.

Good recorded that the ascent had not proceeded far when another man had to be sent back to the creek to recuperate. In the late afternoon the remainder of the party struggled to the summit of Mt Brown. From here they would have seen the *Investigator* anchored in the gulf, the peak, of what Eyre was to later name Mt Remarkable, to the south, and the gradual merging of the hills with the Willochra Plain in the east. Mt Arden would have been most noticeable to the north, and to the west a mixture of plains, mesas and the swampy limits of the head of Spencer's Gulf would have stretched before them.

Considering the effort to gain the summit any view must have been disappointingly short due to fading light. More importantly, the party did not find any water and an attempt was made to descend to a more favourable spot. Following a steady, downhill scramble through low scrub, the group found itself in a dry gully but still well within the range. After an uncomfortable night, reported by both Brown and Good in their diaries, they set off next morning to rejoin the two men who had been left at the foot of the hills.

Good recorded that the servants left behind had found a spring and been warmed through the night by a fire. The water alleviated the thirst of the incoming party members and plants were gathered at this locality.[3] Brown recorded that they had joined the servants by 7 o'clock and he related how:

> A little before 8 o'clock we left the water and about 4 o'clock reached the beach opposite to the ship — all exhausted with fatigue, the heat of the day and want of water. About 5 p.m. got on board.[1]

Retracing the route

To determine the specific route taken by Brown and his party I have carried out field investigations to compare today's terrain with that described in the diaries of Brown and Good. Westall's sketch (Fig. 1; Perry & Simpson 1962, pl. 23) of the area was also examined. The following observations have been made:

a) the only source of naturally occurring permanent water in the area is at Woolundunga Spring (D. Herde, pers. comm.);

b) the pointed hill marked 'a' on Westall's field sketch (Fig. 1) is Saltia Hill;

c) Brown's description 'of a reddish argillaceous stone angular fragments of which interspersed with fragments of quartz, weathered [schistus?] containing thin veins of a metallic substance resembling Molybdena of black lead', reasonably corresponds with samples of micaceous hematite found in a localized portion of the Woolundunga Ridge. Shale, with dendrites, and the fault breccia were found on the ridge at the head of Catninga Gully.[4] The remaining hills toward the summit consist of quartz.

Fig. 1. Westall, William 1781–1850. Spencer's Gulf: a view at the head of the Gulf, South Australia. Pencil sketch: 18 x 26.8 cm. National Library of Australia.

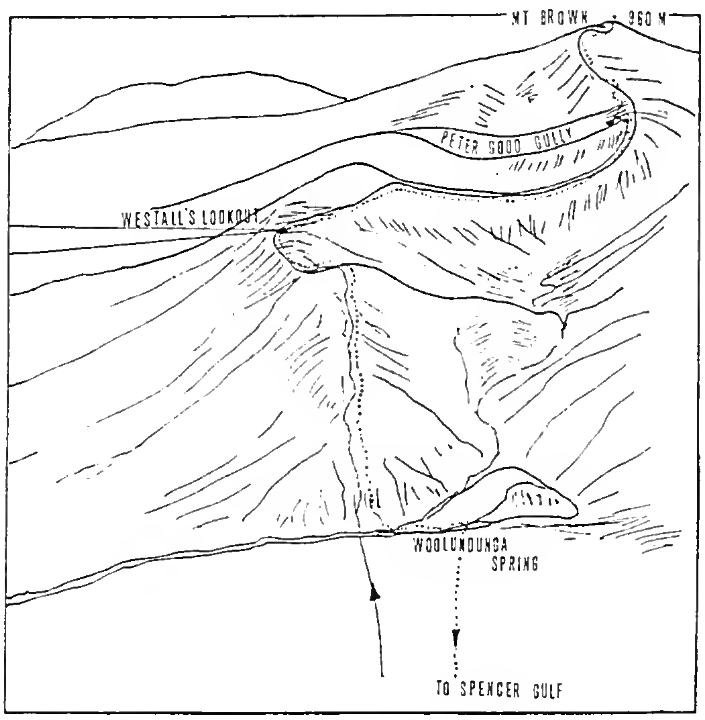

Fig. 2. Field sketch showing the route taken by Brown and company in the Flinders Ranges.

From this evidence it is thought that the ascent started from near Woolundunga Spring.[5] The Woolundunga Ridge and the head of Catninga Gully were then followed to the summit. Under the circumstances of their hurried twilight retreat the most likely site for their overnight camp is Peter Good gully[6], which lies immediately to the east of, and runs parallel with, Catninga Gully. In the morning a quick scramble up the side and over into Catninga Gully, then up the other side to gain the ridge, would have put them well on the way for a speedy return along Woolundunga Ridge.

My investigations suggest that Westall made his sketch (Fig. 1) during the descent on the morning of 11 March. When the site was revisited in April 1988 the features displayed in Westall's sketch were only clearly evident a few minutes after sunrise, and at a point I have referred to as 'Westall's Lookout' in Fig. 2.

Acknowledgements

Prof. Tom Vallance kindly assisted with this project. The sketch by William Westall was reproduced with the permission of the National Library of Australia.

Notes

1. Typescript of a part of Brown's diary were received from Prof. T. Vallance, University of Sydney. The original diary is housed at the British Museum (Natural History).
2. Reference to time in Brown's diary suggests the use of 138° E longitude of GMT for this position. This proves to be 18 minutes behind CST as used in South Australia today. Therefore, when Brown uses 2 o'clock it would correspond to 2.18 p.m. CST.
3. Recorded in Good's diary. It seems likely that specimens of *Psoralea australasica* Schdl. were gathered here. A duplicate specimen in AD, recently acquired from BM, only has the general label 'Spencer Gulf Bay XII March 11th 1802' — which is typical of many of Brown's collections (Stearn 1960). The duplicate is of a

flowering specimen, which suggests that it was growing close to the spring.

4. Specimens of any rocks that may have been gathered in this area have not been seen. Any that were gathered were presumably on the HMS *Porpoise* which was used to transport much of the natural history collection back to England after HMS *Investigator* was left in an unseaworthy condition at Sydney. Unfortunately the *Porpoise* sank after it struck a reef in Queensland waters on 18 August 1803 (Vallance & Moore 1982).
5. See 'Wilmington' topographic map, 1:50,000, for localities.
6. Officially named in *South Australian Govt Gaz.* 24 March 1988.

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The 1851 botanical excursion of Ferdinand Mueller to the Flinders Ranges, South Australia

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Abstract

Aspects of the botany, geography and chronology of Ferdinand Mueller's excursion to the Flinders Ranges are examined. Available data suggests that Mueller gathered about 270 species during the trip. An effort has been made to accurately locate Mueller's collection sites and ascertain visiting dates. The botanical importance of this excursion is considered.

Dr Ferdinand Jacob Heinrich Mueller was only 22 years of age when, accompanied by his younger sisters Bertha and Clara, he landed at Largs Bay, South Australia in December 1847. The migrant ship *Herman von Beckerath* was 152 days out of Bremen. The trio were treated with hospitality; the sisters were cared for by the Davenport family and Ferdinand was soon employed at Herr Heuzenroeder's Rundle Street chemist shop in the developing town of Adelaide.

Heuzenroeder must have been rather liberal in his terms of employment, for Mueller quickly set about exploring the botanical novelties in his adopted country. Sometimes he was alone but was occasionally accompanied by associates such as Charles Stuart.[1] Some of these expeditions were short and repeated, such as those made to the Barossa Valley and Enfield Scrub. Other trips, such as to the Murray Scrub, east of the Mt lofty Ranges, were not only longer but to areas lacking in surface waters, which would have taxed his resourcefulness and bushmanship. By September 1848 Mueller was attempting to sell sets of pressed indigenous botanical specimens, systematically arranged and with notes.[2] It is not known how successfully this enterprise turned out, but in November 1850 (Gemmell 1975) he purchased land in the Bugle Ranges, close to the Davenport family and his older friend, Ludwig Fischer. The tiny hut which gave him shelter and stored his specimens still stands.

During November 1848 Dr Herman Behr arrived in South Australia for the second time. Behr was seven years Mueller's senior and had already made a significant botanical exploration around the Barossa Valley (Kraehenbuehl 1981). In 1849, in a letter to Professor Kunze in Leipzig, he expressed the hope of extending his botanical explorations to Spencer Gulf in the forthcoming spring.[3] It is likely Mueller knew of these intentions. But, by the time the spring of 1849 had arrived, Behr had chosen differently and, about October, left South Australia for good.

Mueller must have been very enthusiastic about the idea of a trip to Spencer Gulf for, in September 1850, he[4] appealed to the Colonial Secretary, Charles Sturt, to be supported in an expedition to the north to collect indigenous plants that may prove of benefit to the Colony. Sturt returned a short, but polite, refusal.[5]

With the new year of 1851 the Government was in the throes of abandoning the system of occupational licenees for holding land and instead instituting pastoral leases. Before this could be done a survey of the northern pastoral frontier was necessary. The Northern Expedition, under the leadership of H. C. Rawnsley, was formed to carry out this task. In February, in an attempt to join the party as botanist and physician, Mueller[6] again wrote to the Colonial Secretary. But, with the colonial coffers low, Sturt was adamant that only surveying crews would go.

The year of 1851 is notable for at least one other event. With a total of 786 mm of rain, it still stands as the wettest year recorded in Adelaide. With likely good penetration of the winter cold fronts into the Spencer Gulf area, Mueller must have been keen to explore for botanical novelties. With all hope of some sort of sponsorship gone Mueller began to consider a small expedition of his own. For information on the area to be traversed Mueller probably called upon men like S. T. Gill and Frederick Sinnett. Gill had travelled to the western flank of Lake Torrens in 1846 with the Horrock's Expedition and had also revisited much of the area in 1847, fulfilling artistic commissions and expanding his experiences (Appleyard et al. 1986). Sinnett, an early surveyor about the Wilpena and Mt Brown areas, had returned to Adelaide about August of 1851, spoke German fluently, and was well known to Mueller (Sinnett 1855).

Mueller by this time had managed to purchase about 60 acres in the Wistow area near Macclesfield. Early in 1851, presumably to raise money for his expedition, he sold 20 acres of this to Ludwig Fischer. But, in spite of geographical information from his contacts, Mueller still faced a formidable problem in a day and age where sign posts were rare and maps often vague. Then, in September, Gill was declared insolvent.[7] It was an opportune moment for Mueller to be assisted on his expedition and there is some evidence (Gill's signature on paintings etc., Grandison unpubl.) that Gill may have accompanied Mueller to at least Depot Creek. However, for the following narrative I am assuming that Mueller was unaccompanied.

Judging from collections made by Mueller late in September 1851 it appears that the house of August

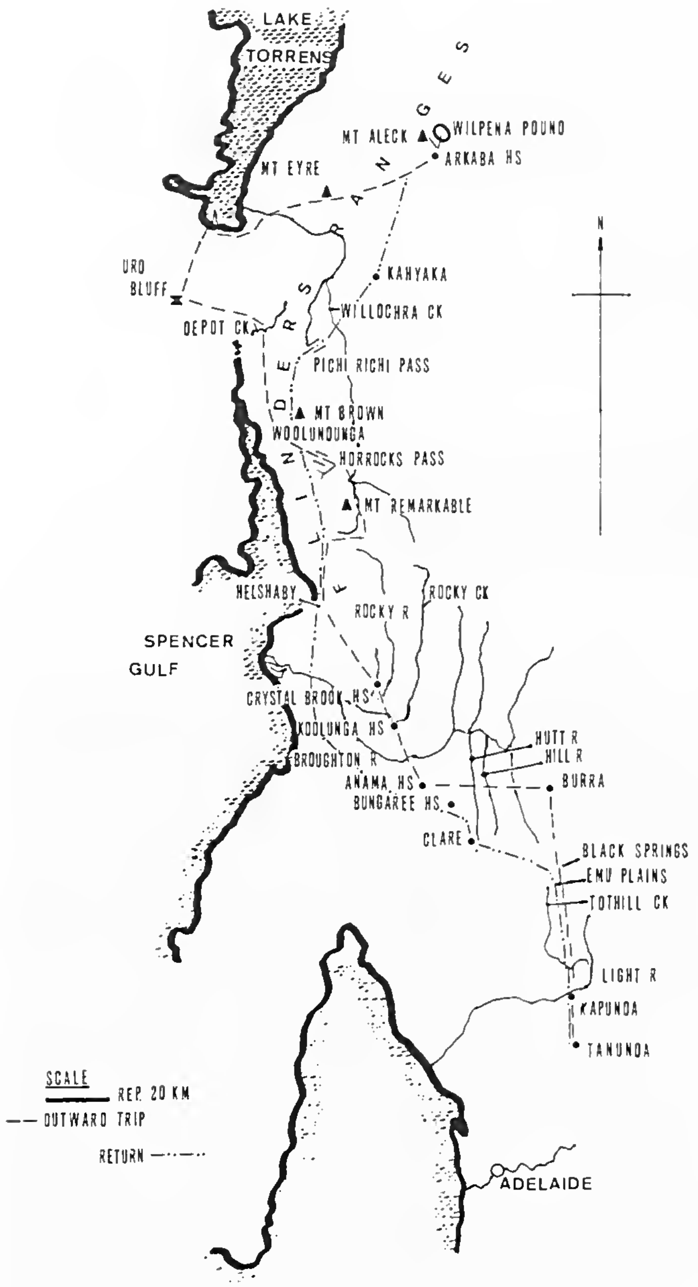

Fig. 1. The 1851 route taken by Mueller to the Flinders Ranges.

Fiedler[8], at Tanunda, was the starting point of the expedition to the Spencer Gulf and Flinders Ranges. It was also the start of my latter day headaches in attempting to piece the succeeding events together. Willis (1949) and Kraehenbuehl (1971) had made reference to the journey but details were lacking. Botanical literature was also misleading, with one author (Kynaston 1981, p. 64) suggesting that Mueller had made more than one trip to the Flinders Ranges. He only made a single trip[9], and the route taken is displayed in Fig. 1.

Sources of information

Mueller does not appear to have kept a diary of the trip. Therefore, information provided below on the plants, collecting localities, and dates of the trip, have been gained from other sources. Few unpublished letters pertaining to the trip have been located.[9,24]

Many of the species gathered on the trip, plus specific localities, were referred to in 'Diagnoses et descriptiones plantarum novarum in Nova Hollandia . . .' (Mueller 1853a) and in 'Plantae Muellerianae . . . Compositae' (Sonder 1853). Specimens were also cited by Bentham (1855, 1863–1878), and by Mueller in other publications, including *The plants indigenous to the Colony of Victoria* (Mueller 1862). Various revisions by other authors also cite collections gathered by Mueller (e.g. Barker 1982). Mueller's account (Mueller 1853b) of the vegetation of the Lake Torrens area provided little information on localities and species collected, referring to plants mostly at the generic or family level.

Herbarium specimens, particularly at the National Herbarium of Victoria (MEL), but also at the Herbarium, Royal Botanic Gardens, Kew (K) have provided much data on localities and dates of collection. Searches have so far revealed that about 270 species were gathered on the trip.[10]

The search for geographical names was facilitated by reference to records at the South Australian Department of Lands. However, some sites, such as Ultonulta, have been impossible to locate. Local knowledge was required to rediscover sites on Mueller's 'Rocky Creek' that could be described as 'stony declivities'. This creek is now known as Yaekamoorundie Creek.

The excursion

As far as can be ascertained from the limited records it appears that Mueller left Adelaide for Gawler and Lyndoch on, or about, Thursday 25 September 1851. Besides being mounted he may have had one or two pack horses in tow, but no details of this aspect of preparation are known.

Fiedler's house at Tanunda was probably reached on the 27th during some inclement weather.[11] Back dating known events suggest Mueller left Fiedler's place on Monday the 29th, travelling to Kapunda where just a few specimens were collected, then onto Dutton's place on the River Light. The next day he seems to have reached the Burra Mines. This travel would have presented no difficulty as both the Kapunda and Burra mine trails were very distinct as a result of the coming and going of bullock teams hauling copper ore. Mueller collected sparingly, only taking specimens of a *Swainsona* Salisb., *Acacia paradoxa* DC. and several composites. Although Gill had been to Burra several times previously for painting no contacts are known for this trip and Mueller did not stay long before heading westward towards the Camel's Hump, north of Clare. In the vicinity of the small streams of the Hill and Hutt Rivers another small plant collection was made.

Pushing on past what had recently been John Watt's Anama Run he struck the Broughton River, somewhat downstream of present day Yacka township, and followed the trail to John Hope's station. The station homestead, now a mere foundation ruin in a paddock, overlooks the Yaekamoorundie Creek ('Rocky Creek' of Mueller) where, according to Mueller, it is set in a stony declivity. Around here he collected approximately a dozen plants on or about 4 October. On the way to Crystal Brook, which was probably the station run by Peter Ferguson rather than the very small settlement of the same name, he crossed the Rocky River. Once more a small collection was made, mostly of *Acacia saligna* (Labill.) H. L. Wendl., some crucifers and several introduced weeds.

At Crystal Brook his collections were more extensive than had hitherto been the case. Here he collected syntype specimens of *Sida petrophila* F. Muell.[12] and *Erysium trisectum* F. Muell.[13] [= *Arabidella trisecta* (F. Muell.) O. Schulz], with at least the former being gathered on 7 October. A number of annual composites were also collected here, as well as several introduce weeds, a sure sign of the pastoral invasion. Collection labels suggest that, after a day or so at Crystal Brook, he wandered out towards Pirie Harbour then back to the ranges to Nelshaby where there was a soak. Here, in the immediate outwash of the gorge, grows almost a monoculture of the Flinders Range wattle, *Acacia iteaphylla* F. Muell. ex Benth. It is probably here that Mueller collected type material of the species. The syntype at K has Arkaba given as the locality but this seems to be an error. *A. iteaphylla* has not been collected east of the coastal ranges nor much further north than Pt Augusta (Whibley 1980).

From here a move, along the coastal foot of the range, was made to Baroota. In the sheltered bed of Stony Creek he collected syntypes of *Teucrium petrophilum* F. Muell.[14] (= *T. corymbosum* R. Br.). Gill had made several paintings in the area of the Stony Creek gorge in 1846 and 1847. *Parahebe decorosa* (F. Muell.) B. Briggs & Ehrend. (syn. *Veronica decorosa* F. Muell.) grows about the twin waterfall area painted by Gill and it may be that the syntype specimens of *V. decorosa* were gathered here.[15] From the gorge Mueller struck up the steep slope into the ranges, along what was to become known as the Bridle Track, and emerged at or near Yeates's Station on Wild Dog Creek, which is just north of the present day township of Murraytown.

Several days were then spent in the area of Mt Remarkable. It appears likely a northern approach to the mountain was made along the course of Spring Creek. This approach had been pioneered in 1846 by Gill, and Colin Campbell who had a run near present day Melrose. Here a horse can be ridden a good part of the way up the slope, which compares favourably with the difficult ascent necessary from the Melrose side. Mueller made a collection of acacias, including *Acacia notabilis* F. Muell.[16] Several taxa with restricted distribution, such as *Hovea beckeri* F. Muell.[17], *Euphrasia collina* R. Br. subsp. *tetragona* (R. Br.) Barker[18], *E. collina* subsp. *muelleri* (Wettst.) Barker[19] (both now locally extinct), *Eucalyptus albens* Benth.[20] and *Pultenaea hispidula* R. Br. were also gathered at Mt Remarkable.

By about the 16th he was near the eastern entrance to Horrocks Pass, or Beautiful Valley as it was then known. A detour to what is now known as Hancock's Lookout has been identified as a Gill painting site. In the coastal distance and separate from the main range is Mt Gullet. Downhill from the lookout, and on the head-waters of Mt Gullet Creek, Mueller collected the introduced *Malvastrum americanum* (L.) Torrey (Kloot 1983).

Travelling through Horrocks Pass and back to the coastal side of the ranges, he briefly stopped at Woolundunga Spring, the only source of permanent water in the area. Then he hastened on, crossing Saltia Creek en route to Eyre's Depot Creek. As permanent water was available from springs in the gorge Depot Creek had been the site of the main base camp for the 1846 Horrock's Expedition to the northwest. During his stay Gill had sketched several scenes here. One of them[21] portrays a singular kind of small tree which could be *Codonocarpus pyramidalis* (F. Muell.) F. Muell. Today this species is locally common on the hillsides around Depot Creek[22] but no specimens seem to have been gathered here by Mueller. In his description of the species, as *Gyrostemon pyramidalis* F. Muell., he only made reference to collections gathered in the Elder Range.[23] In fact very few plant collections from Depot Creek have been located. It is also evident from my investigations that any collections labelled as coming from Mt Arden should probably be considered to be from Depot Creek. The difficult terrain and limited time spent here make it seem highly unlikely that the mountain was very closely approached, let alone climbed.

From Depot Creek Mueller moved west-northwest across the open saltbush plain, the saline flats at the head of Spencer Gulf, to the abrupt edge of Uro Bluff. Mueller would have known from preparatory information that he could expect to find little water in this area. He collected with more zeal as he headed northward over the tableland towards the thinly salt-erusted Lake Torrens. Some years later Mueller[24] commented about how he had seen the Banded Ant-eater or numbat (*Myrmecobius fasciatus*) on the lake. This creature, now extinct in South Australia, probably inhabited the cavities in the edge of the lakeside tableland, coming onto the lake surface to feed on the numerous ant populations. The habitat must have impressed Mueller for it stimulated the only known general article of the whole trip, 'The vegetation of the districts surrounding Lake Torrens' (Mueller 1853b).

By about 23 October he was following the Willochra creek upstream towards the ranges and eventually the marker of Mt Eyre. This area had been recently surveyed by Frederick Sinnett (Sinnett 1855) so it is likely that Mueller was able to replenish water supplies at Hookina Water, which is on the creek of the same name. From here he moved upstream along Hookina Creek, through Mayo Gorge, following the creek to Arkaba Station. Here Mueller was apparently warmly welcomed by George Marchant, with Mueller (1853a) specifically mentioning his hospitality.

An apparently short trip was then made to Wilpena Pound. Only four collections from here have located. This suggests that Mueller did not reach the diverse microhabitat areas near the present day Chalet. The horseback route is likely to have been from Arkaba Station to Black Gap, then to the Pound on the southern flank by way of Bridle Gap. This was the common short cut between Arkaba and Wilpena Stations at that time (H. Mineham & F. Teague, pers. comm.). Mueller's collection of *Cyperus lhotskyanus* Boeckler or flat-sedge[25] is likely to have been gathered at the permanent waters of nearby Black Gap. The southern Pound was Mueller's furthest point north for the trip.

North from Arkaba Station it is a comparatively easy ride through Madge Gully to the base of Mt Aleck. Although he doesn't name this point in his collections Mueller does make reference to the 'summits' of the Elder Range.[26] It is a considerable climb to the top of the range, being almost vertical in places. Here he collected type material of a number of plants, including *Gyrostemon pyramidalis* F. Muell.[23] [= *Codonocarpus*

pyramidalis (F. Muell.) F. Muell.], *Eriostemon halmaturorum* F. Muell.[26] [= *E. linearis* Cunn. ex Endl.] and *Didiscus glaucifolius* F. Muell.[27] [= *Trachymene glaucifolia* (F. Muell.) Benth.].

Late in October he prepared for a fairly rapid southward return. Part of the return route from Arkaba Station may have retraced Mernmerna Creek to the junction of Wonoka Creek, the confluence being the start of Hookina Creek. Wonoka Creek can be followed a good way south before leaving its upstream southeast trend and heading for Yourambulla Peak. This was an early standard route to and from Arkaba (Jessop 1862). From here it is easy travel to Kanyaka, or as Mueller called it, Cudnaka, a locality at which he gathered about 70 specimens, mainly herbs. This is the largest known single collection for the trip. While here he collected type material of *Chara contraria* Braun[28] (= *C. vulgaris* L.), an alga still to be found in a few permanent pools in Kanyaka Creek.[29]

To make the eastern end of Pichi Richi Pass he had to cross the Willochra Plain which was occupied by vast numbers of a species of Kangaroo Rat or Bettong. Their extensive systems of burrows made the plain difficult for horses to travel over without accident. No collection is known for this leg of the journey.

After negotiating Pichi Richi Pass he arrived once more on the coastal plain of eastern Spencer Gulf. Back at Woolundunga Spring, at the western base of Mt Brown, Mueller made another small collection. A syntype specimen of *Abutilon halophilum* F. Muell.[30] is of particular interest for, after writing 'Oc', the first two letters of October, on the label, he crossed them out and put the date as November 1851, thus providing a fairly accurate date of his arrival. A few moisture loving plants such as *Parahebe decorosa* and *Asperula syrticola* (Miq.) Toelken were more than likely sheltering close to the spring. The small size and content of the collection gathered here suggests that no time was taken for the steep climb to Mt Brown, a trip made by Robert Brown and company 49 years before (see accompanying paper in this volume).

About three days later he was at Crystal Brook. A late collection of a few plants labelled as 'November 1851' demonstrates his presence here. A specimen taken on 7 November 'toward the apex of St. Vincent's Gulf, Broughton River'[31] suggests that he headed south from Crystal Brook, intersecting the Broughton River near the current township of Redhill. From here he followed the river upstream until striking Hope's Trail, which led him via Bungaree Station to Clare. Mueller collected several introduced plant species here, the only apparent indigenous species gathered being *Thysanotus baueri* R. Br. (syn. *T. humilis* F. Muell.[32]). From the infant village of Clare he headed towards Emu Flat (32 km NNE of Kapunda), arriving back at Tanunda on, or about, 12 November.

After about six weeks in the bush Mueller had accomplished much with limited personal resources. From temperate areas he had travelled into the arid fringes of South Australia, making the first scientific plant collections in the area since Robert Brown in 1802. It is hardly surprising therefore that his collection contains a large number of type specimens. Of about 270 species collected during this trip, approximately 90, all deemed to be new to science, were described from specimens gathered on this excursion.

In July 1851 the change of land policy, from occupational licences to pastoral leases, was the start of a trend towards closer land settlement. This had mostly disastrous results for the indigenous flora. On the limits of the pastoral frontier Mueller had collected what was the beginning of a flora of introduced plants, many of them weedy species.

Although about 270 species were gathered by Mueller plant groups in some localities appear to have been poorly collected. This may reflect seasonal variation or perhaps a loss of some specimens during the journey or at a subsequent time. With regard to cryptogams it is possible that any such collections, if made, would have been directed to European specialists of the day.

The paucity of written details of this trip, along with the possible distribution of unicates from MEL, is unfortunate as it has tended to underrate the importance of this collection and has led to inaccuracies by some workers when examining material. This alone seemed reason enough for attempting to piece together the diverse data on this trip that survive today.

Acknowledgements

Several descendants of Mueller's relatives assisted with this project: Mrs Beryl Arthur, the late Mr A. V. Stenhouse and his son Neville, and Mrs Melva Armstrong.

A number of researchers shared their knowledge with me: Dr Thomas Darragh, Dr J. H. Willis, Bishop Rosier, Hans Mincham, Mr K. T. Borrow L.L.B., David Schubert, Heather Sizer, Ted Mertens, Fred Teague, Jack Babbage and Pauline Powell.

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To all these people, as well as friends such as Margaret & Heinz Wild of Wirrabara, and my wife Sue, I extend my sincere thanks.

Notes

1. Charles Stuart sailed to Launceston in the brig *Henry* about April/May 1848. (MS notes compiled by J. H. Willis, MEL library.)
2. Advertisement in *The South Australian Register*, dated Wednesday, 20 Sept. 1848, p. 2a.
3. Letter from Behr to G. Kunze, sent from Tanunda, dated 14 April 1849. Published in *Bot. Zeitung (Berlin)* 7: 873–876. Translated from German by Mrs D. Sinkora (MEL).
4. Unpublished letter from Mueller to Sturt, dated 25 September 1850. G.R.O. 2111 Adelaide.
5. Unpublished letter from Sturt to Mueller, dated 27 September 1850. G.R.O. 537 Adelaide.
6. Unpublished letter from Mueller to Colonial Secretary's Office, dated 18 February 1851. G.R.O. 380 Adelaide.
7. *South Australian Govt Gaz.*, 11 September 1851, p. 634.
8. Fiedler arrived in the Colony in November 1838 with Pastor Kavel and many other German migrants. His house, which is still standing, on section 1 of the Hundred of Moorooroo in the Barossa Valley, was a place of focus for a developing intellectual community (Grandison 1985).
9. Mueller, in a letter dated 10 October 1882, to his niece Louisa Wehl, postmistress at Appila, stated that '. . . I was only once in your locality, I got a few plants, merely passing through on my way to the Flinders- and Elders-Ranges. It was spring also . . .'. Appila is on the eastern edge of the southern Flinders Ranges. Original letter in MEL library.
10. A more or less complete listing of the collections gathered by Mueller on this trip are held by the author. A more incomplete list is held at MEL.
11. Statistics supplied by the Bureau of Meteorology show that a cold front, with rain, passed through Adelaide and it probably penetrated the Barrosa Valley.

12. *Linnaea* 25: 381 (1853). Syntypes at MEL include: 'An schattigen felsigen Abhängen im Flinders-range, 7 Oct. 51, Dr. M.' and 'Crystal brook, N. Holl. austr., Oct. 51, Ferd. Mueller, Dr.'
13. *Linnaea* 25: 386 (1853). Lectotype: Crystal Brook, Oct. 1851 (MEL), *fide* E. A. Shaw, *Trans. & Proc. Roy. Soc. South Australia* 89: 179–181 (1965).
14. *Linnaea* 25: 426 (1853). Two syntypes at MEL: 'Wulpena, Baruta, Crystal brook in the stony beds of the creeks and amongst the rocks on the hills. Oct. 51. Dr. M.' and 'Zwischen Wulpena & Arkaba an ausgetrockneten Bächen Oct. 51.'
15. *Linnaea* 25: 430 (1853). Two syntypes at MEL: 'In vallibus tractus montani Flinders-ranges prope M. Remarkable, M. Brown & locces interdos. Oct. 51. Dr. M.' and 'In vallibus saxosis montium Flinders-ranges. Oct. 51.'
16. *Fragm.* 1: 6 (1858). Syntypes at MEL include: 'Flinders-range! Nov. Holl. austr. Oct. 51. Ferd. Mueller, Dr.' and 'In interioribus Nov. Holl. austr. M. Remarkable versus. Oct. Li.'
17. MEL 106347, MEL 664285, see Ross 1988.
18. HBG p.p., see Barker 1982, p. 194.
19. MEL 41490, see Barker 1982, p. 212.
20. J. E. Brown (1890) referred to part of a letter from Mueller re the presence of this species near Mt Remarkable.
21. See Art Gallery of South Australia holding 'Looking NW from Depot Creek near Mt Arden' by S. T. Gill.
22. *Grandison 5090* (MEL).
23. *Linnaea* 25: 438 (1853). T: 'In collibus humilibus parum fertilibus loci Moralalle nativis dicti prope montes Elders-range, ubi primo reperit cl. George Merchant [Marchant].' Five syntypes at MEL; MEL 589695–589699.
24. Unpublished letter from Mueller to F. McCoy, dated 10 February 1869. National Museum of Victoria. Inward correspondence 1856–1950, box M.
25. Collection mounted on two sheets, MEL 517280 & 517281, and with the label 'Wulpena. N. Holl. austr. Oct. 51, Ferd. Mueller.'
26. *Linnaea* 25: 376 (1853). T: 'Ad summitates lapidosissimas vix adscendendas montives Elders-range dictorum et circum jacentium.' Mueller also recorded that this plant was known as 'Rock Wallaby shrub'. This presumably alludes to the habitat of the Yellow-footed rock wallaby, *Petrogale xanthopus*, which is still found in small colonies in the Elder Range.
27. *Linnaea* 25: 395 (1853). T: 'Unico tantum loco reperi, nempe: ad quondam rivulum inter Moralalle et Elders-range in solo rupestri tempore plumviarum humido, umbrato.'
28. *Linnaea* 25: 708–709 (1853). 'In Nova Hollandia australi interiore prope Cudnaka legit. Dr. F. Müller.'
29. It is possible that the Kanyaka area was brought to Mueller's attention by geologist Dr George Bruhn, who searched for coal in the region in the summer of 1849 (Bruhn 1849). Bruhn arrived in South Australia on the same ship as Mueller.
30. The label information was recorded some years ago by Mrs D. M. Sinkora. At the time the specimens were unmounted and unnumbered. This particular label no longer accompanies syntype specimens of *A. halophilum* (MEL 594392, MEL 594393). It was probably discarded when the specimens were mounted.
31. J. H. Willis pers. comm., specimen at MEL not seen by me.
32. *Fragm.* 1: 22 (1858). T: Broughton R. and Clare village, Nov. 1851, *fide* N. H. Brittan, *Brunonia* 4: 94 (1981).

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Carl Wilhelmi, the seedsman from Dresden: his botanical endeavour in South Australia and Victoria

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Abstract

Some details of Carl Wilhelmi's botanical activities in South Australia (1849–1855) and Victoria (1855–1869), including a list of his publications and notes on his collections, are provided.

Johann Friederich Carl Wilhelmi (1829–1884, Fig. 1), a seedsman from Dresden, sailed to Australia from Hamburg, arriving at Port Adelaide on board the *Godeffroy* on 1 March 1849. Wilhelmi was a member of the Dresden Missionary Society and at one stage was Assistant Protector of the Poonindie Mission on Eyre Peninsula, where he gathered a number of undescribed plants. He also collected specimens in the vicinity of Adelaide, along the River Murray, and on Kangaroo Island. He moved to Melbourne in 1855, where for a time he was Acting Government Botanist (Black 1936; Kraehenbuehl 1986). Wilhelmi returned to Germany in 1869.

Fig. 1. Portrait of Wilhelmi, aged 47. Taken from an original oil painting on which Wilhelmi recorded that it was painted, and received as a gift on 16 Aug. 1876, from his friend Günther Reibisch.

Wilhelmi recounted his early years in South Australia in a lecture on 14 September 1857 to the Melbourne German Club. The lecture was subsequently published (Wilhelmi 1857b) and translated extracts, along with unpublished letters, have been extensively used in the compilation of this account of Wilhelmi's botanical exploits in South Australia and Victoria.

South Australia 1849–1855

The year of Wilhelmi's arrival in South Australia, 1849, was an important milestone in South Australian botanical history as four other renowned botanists, H. H. Behr, W. Hillebrand, F. J. H. Mueller and J. G. O. Tepper, all resided in the colony during the first half of the year (Kraehenbuehl 1981, 1986). Only a fortnight after disembarking at Port Adelaide, Wilhelmi made his first acquaintance with Mueller. Wilhelmi, and a fellow business companion, were on an excursion to the German Paddock (Bugle Ranges), an area where many Germans had settled soon after the establishment of the Colony of South Australia. At Crafers he enquired the way to the German Paddock. Wilhelmi recorded:

> The road, which was shown to us, was at that time nothing wider than a cart rut, which avoiding the fallen tree trunks, lead between them. We also came to a junction and were so clever as to get onto the wrong track. After we travelled a mile along it, it lost itself in the forest, so that nothing remained for us but to return back on it. Fortunately a man came towards us, who was loaded up with plants and of whom we asked the way. When he saw that we were foreigners he spoke to us in German and I scarcely need to describe how happy we felt to meet a fellow countryman in the middle of such a wilderness. This, however, was none other than our now celebrated Dr Ferdinand Mueller and in this way I made my first acquaintance with him. After he heard that I had come to Australia especially to collect natural history specimens, he invited me to visit him on my return, showed us the right way and wished us a happy journey.[1]

This first venture into the South Australian bush was aborted by a gig accident where the vehicle overturned on a fallen log and the horse was badly injured. Nevertheless, he continued alone to the German Paddock, delivered a number of letters to German immigrants, then returned to Adelaide.

Wilhelmi's second major trip was in October 1849 to Wellington on the River Murray, and to Thompson's Station 16 miles (29 km) upstream. He noted:

> The track led over beautiful, thickly forested hills and wide valleys as far as Strathalbyn, a pretty little place, situated quite near the bank of the Onkaparinga [he meant the River Angas], and at that time consisting of only a few houses. From here the region became flatter and soon I came into thick scrub, which stretched right up to the vicinity of the Murray River and through which a track the post wagon was cut. Although a large selection of plants, which were interesting for me, grew in this scrub. I could not stay for long here on account of the deficiency of water and consequently I continued on my way, which wound between many large salt lagoons. These gave the landscape a real appearance of winter because they were covered with a snow white, thick salt crust. Then the region became sandy again, which increased the nearer I came to the Murray.[1]

In his account of this excursion Wilhelmi recorded little about his botanical exploits. But, he made discerning observations on the native bird life and the aboriginal inhabitants along the river.

> The reed bed was alive with masses of all kinds of bird life, which now and then was flushed by birds of prey. Black swans, pelicans, wild geese and ducks swam up and down, while the various large snipe species, native companions and snow white herons lived upon the banks of the river. Many families of Aborigines were camped not far from the houses, others travelled backwards and forwards with their craft constructed from the bark of trees and brought some of the beautiful, large Murray Codfish as a present for the inhabitants.
>
> I made excursions into the surroundings of Wellington. The first day I followed the left bank of the Murray, on which stood the house of the protector of Aborigines and where a number of aboriginal women were occupied in plaiting baskets and table covers from bullrushes, which grow here in large numbers, while the male personnel were catching fish. The latter sat in their canoes not far from the bank. They had tied the canoes on to large spears, which they had thrust into the ground for this purpose and which they also use as paddles. A small fire burnt in the middle of these small craft, at which they could light their pipes and so equipped they sat, throwing a sharp eye on their lines, as if rooted to the spot.[1]

On the sandy banks of Lake Alexandrina he observed the Murray lily, *Crinum flaccidum* Herbert, 'a beautiful lily-like plant with large white blooms and exquisite perfume the bulbs of which weigh two pound.'[1]

The journey was conducted over a period of two months with Wilhelmi returning to Adelaide in December because of financial difficulties. But his appetite was whetted for further adventure and he returned to the River Murray in the summer of 1850–1851 for three months. His route was via Gawler, Tanunda and Wheal Barton Mines (near Truro) to Moronda (Moorunde). He then proceeded downstream, visiting locations such as Purnong Landing, Thompson's Station, Wellington, Lake Alexandrina and Goolwa.

Wilhelmi was accompanied on this trip by a friend of his fathers in Dresden, Herr Zapf. On their second day they had reached Moorunde. Here he described some of the plants found along the river.

> On the second day we left this so charmingly situated little place and followed the Murray, on the right bank of which grew attractive giant eucalypts which protected us somewhat from the glowing hot rays of the sun. Directly on the bank grew the beautiful *Swainsona greyana* thickly strewn with red blossoms, while the small ponds (backwaters), which are formed here at the Murray, are covered over with one of the dainty water plants (*Azolla rubra*) and look as if covered with a dark red cloth. Soon the river on both sides became so enclosed by the high vertically rising cliffs, that we were compelled to climb up them, which for my somewhat heavy companion was no slight task. However, before we betook ourselves into the higher regions, we busied ourselves for a long time with chiselling out fossil shells which occur here in large numbers in the limestone formation and which I sent over to Privy Councillor Reichenbach in Dresden after my return.
>
> The vegetation which we found here on the high banks of the Murray consists principally of *Salicornia* and behind this *Eucalyptus dumosa* and Murray scrub; further down the river the banks became sandier on which places the Murray-pine (*Callitris*) forms pretty shaded little woods, in which one can only advance slowly on account of the deep sand.[1]

In relation to native vegetation along the river between Morunde and Purnong Landing, Wilhelmi has given us a tantalizing glimpse of unspoiled habitat:

> The vegetation encountered here was rather the same as we had already noticed earlier; now and then we had to pass through magnificent little patches of pines, then we again came through stretches covered with scrub, or passed by large lagoons, which were covered with countless species of birds and were shaded by attractive eucalypts. Often small sand hills rose up between the pines, thickly covered with the pretty Murray lily, which made themselves noticeable from afar by their strong, delightful fragrance. Near the river, on places flooded by it in winter, the shrub-like Polygonum cunninghamii [= *Muehlenbeckia cunninghamii* (Meissner) F. Muell.] grew in great masses, under which native pigeons, which occur here in large numbers, usually stayed on hot days.[1]

In the neighbourhood of Taylor's Fairy Station (Purnong), Wilhelmi discovered *Acacia wilhelmiana* F. Muell., a wattle commonly occurring on sandy loams throughout the Murray Mallee and Eyre Peninsula regions of South Australia. Of this discovery Wilhelmi proudly chortled 'I was so fortunate to find a new species of the genus *Acacia* which Dr Mueller was so kind to name after me.'[1]

In late 1851 Wilhelmi travelled to Eyre Peninsula collecting plants, natural history specimens and taking copious notes on local aboriginal tribes. Some of the places visited by him included Pt. Lincoln, Tumby Bay, Boston Point, The Fountain and Long Lake, Memory Cove, Marble Range, Mt Dutton, Lake Greenly, Venus Bay and Lake Hamilton.

Wilhelmi[2],3 also noted in a letter, dated 31 December 1855, to William Hooker, that 'In November last year I made a botanical excursion into the western part of South Australia, where I had been collecting once before in 1851. . .'. He then proceeded to list the 'new plants' that he had discovered in this region in '1851 & 1852' (12 taxa from the vicinity of Pt Lincoln) and '1854 to 1855' (ten species). The list included the following plants, some of which are endemic to South

Australia: *Dodonaea hexandra* F. Muell., *Eucalyptus cladocalyx* F. Muell., *Haeckeria cassiniaeformis* F. Muell., *Schuermannia homoranthoides* F. Muell. [= *Darwinia homoranthoides* (F. Muell.) J. Black], *Trichinium beckerianum* F. Muell. [= *Ptilotus beckerianus* (F. Muell.) ex J. Black], and *Verticordia wilhelmii* F. Muell. In the same letter to Hooker, Wilhelmi lamented that his scientific excursions had cost him a good deal of money. He noted:

> If I had the means . . . I would be of great use to science principally by exploring the Port Lincoln district — the Gawler Ranges, which have as yet not been visited by a botanist, and where he may hope to be richly awarded. I was not able to penetrate so far from want of water — from £60 to £80 would enable me to collect there during the summer months and I should be sure of a goodly number of plants, seeds and other specimens of natural history.[2]

Financial assistance for Wilhelmi was not forthcoming. He never collected in the Gawler Ranges, a region that still warrants urgent attention from botanists.

During his stay in South Australia Wilhelmi also visited Mt. Gambier, where, as shown by specimens at the National Herbarium of Victoria (MEL), he collected mosses from volcanic caves 80 feet deep (J. H. Willis, pers. comm.).

Wilhelmi spent much of his time in Australia enquiring into the food plants of native tribes in South Australia and Victoria. In particular he (Wilhelmi 1860) recorded much valuable information about the aboriginals of the Port Lincoln district. He referred to their use of such delicacies as the inner heart of the grass tree (*Xanthorrhoea* Smith), the succulent fruit of a *Mesembryanthemum* (presumably a species of *Carpobrotus* N. E. Br.), called karkalla, and various fungi. He (Wilhelmi 1860, p. 172) further noted:

> All other edible fruit grow in pods, or in the shape of berries on small bushes. Some of these they allow to ripen, as, for instance, the fruit of the santalum and that of species of epacris, which growing on the seashore, bears small red sweet berries called 'wadnirri'. Another plant, 'karambi', also growing on the seashore, is the *Nitraria billardierii*. Other fruits they collect before they are ripe, and roast them in hot ashes, such as the berries of the pulbullu, and the pods of the menka, and the nundo. The last-mentioned fruits, highly valued by the natives, are of the acacias, growing abundantly on the sandy downs of Sleaford and Coffin's Bay, and by attracting thither a numerous company of blacks, they frequently give occasion for dissension and quarrels. As a proof of the value of consideration attached to this fruit, it may be mentioned that, in order to annoy their adversaries, the Kukata tribe of the north-west, famous for their atrocity and witchcraft, often threaten to burn or otherwise destroy the nundo bushes.

Victoria 1855–1869

Sometime in 1855, Wilhelmi removed to Melbourne. Possibly his friendship with Ferdinand Mueller, by then Victorian Government Botanist, persuaded him to leave South Australia for Victoria. After Mueller was appointed botanist to A. C. Gregory's North Australian Exploring Expedition, Wilhelmi was Acting Government Botanist.[4] He recorded that he was appointed to this position on 8 April 1856, with the salary of £200 per annum, and that his duties were 'to arrange the Herbarium of the Government for delivery to the University, to collect living plants and seeds for the garden and procure specimens for another Herbarium.'[5] Wilhelmi must have remained in this position until June 1857, as evidenced in another letter to William Hooker in which he noted that Mueller would not be returning to his duties before that time.[6]

One of Wilhelmi's first trips into the Victorian forests were to the Dandenong Ranges. Here he collected many species of orchids, ferns, mosses and other plants. He was fascinated with the 'tropical aspect of Ferntree Gully':

> We saw the *Alsophila australis* from 40 to 50 feet high, the trunks covered with *Polypodium*, *Hymenophyllum*, *Blechnum*, *Tecoma latrobei* [= *Pandorea pandorana* (Andr.) Steenis], young *Atherosperma moschatum*, *Eurybia argophylla* [= *Olearia argophylla* (Labill.) Benth.] etc. *Acacia melanoxylon* grew here to a height of from 50–100 feet, and a *Eucalyptus* measured 6 feet from the ground, thirty feet in circumference. A friend of mine informed me that a *Eucalyptus* has been seen, the trunk of which measured 205 feet, and at this height had a diameter of two feet. The circumference of the trunk was 70 feet.[2]

Towards the closing months of 1856, Wilhelmi regretted his lack of opportunity to visit the River Darling 'on account of the great delay in obtaining the consent for my excursion, when the season was already too far advanced, and secondly because only a very small sum for my excursion had been allowed.'[6] However, this intrepid traveller was not to be denied. On 8 December 1856 he left Melbourne, accompanied by an assistant Dr Schenk, for the Grampians, Victoria Range and the Pyrenees in western Victoria. A vivid and detailed account of their expedition in the mountains from 15 December to 28 January 1857 was later published (Wilhelmi 1871a). Some details of the expedition were recounted in a letter to William Hooker:

> We reached Mt Sturgeon on the 15th of December. Here I stayed a fortnight, ascended Mt Sturgeon, Mt Abrupt and made an excursion to Mt Napier and Mt Rouse. The vegetation on these two volcanoes distant from each other about 12 miles, I found quite the same — and also quite conforms with the vegetation of Mt Gambier, which is distant 90 miles there from, and again the same as on the hill of volcanic debris of Mt Warrenup near Ballarat.[6]

In the same letter he recorded that, at Mt Abrupt,

> Around us flourished luxuriantly and abundantly the most beautiful plants — several species of *Pultenaea*, a beautiful *Epacris*, *Dodonaea procumbens* and *cuneata* were in full blossoms, a *Leptospermum* thickly covered with its white blossoms, was visited by myriads of insects even at this height, the *Gnaphalium* raised its white and diminutive heads between *Correa aemula* — at their feet flourished the beautiful *Polypodium billardierei* [= *Grammitis billardieri* Willd.]; in other spots there was to be seen in small bushes the *Paryphyntha mitchelliana* [= *Thryptomene calycina* (Lindley) Stapf] sometimes covered with several kinds of lichens. The lovely little *Stylidium soboliferum* formed between thee rocks small green patches (similar to our saxifrages in the Swiss) shaded over by the dark green of the pleurandras [= *Hibbertia* Andr.spp.]. A small *Utricularia* raised its blue little heads out of a dark green moss near the waterfall which in wintertime rushes down with immense violence broken in its course three times from a height of between 200 to 300 feet, but at this season is reduced to a small jet.[6]

Wilhelmi spent five days near the summit of Mt

William (1167 m), the highest point in the Victoria Range, making many seed and plant collections. But his progress was hindered by blackened areas and fallen trees where a small bushfire had recently passed. Despite the fire there were still verdant spots.

> In the valley there was a real tropical vegetation. *Alsophila australis*, *Dicksonia antarctica*, and a mass of smaller ferns grew in the greatest splendour, and on both sides of the creek which rushes down this beautiful valley, grew the *Humea elegans* in thick clumps in full flower sometimes reaching the height from 12 to 15 feet — on the highest points of the Victoria Ranges as well as on Mt William we found everywhere springs of the clearest fresh water, and it would have been indeed fatal to us but for this provision of nature.[6]

Another of his excursions that has been well documented was to Corner Inlet (Gippsland) in November 1861, where he collected wood specimens for the London Exhibition.[7] At Muddy Creek he enthused about some of the luxuriant vegetation:

> *Pittosporum undulatum* I have seen from one and a half to two feet in diameter, and from sixty to eighty feet high; *Melaleuca squarrosa* from 80–100 feet high and one and a half feet in diameter; and the *Prostanthera lasianthos* which usually exists only as a bush, can be seen here as a tree from sixty to eighty feet high, and from eight to ten inches in thickness. I collected leaves from melaleucas and prostantheras for distillation, and bark from *Acacia verticillata*, which I was informed is the best species for tanning. Snakes are here in such numbers that you cannot go anywhere without a stick in your hand to defend yourself, as sometimes they will not move out of your way, and native bears, flying squirrels and Lyre-birds are here also very numerous.[7]

He also observed specimens of blackwood (*Acacia melanoxylon* R. Br.) 100–150 feet high, blue gum (*Eucalyptus globulus* Labill.) reaching a height of 300 feet, and musk daisy (*Olearia argophylla*) which grew 'in great quantity' and had 'a beautiful grain and a hardwood'.[7]

One of Wilhelmi's rare trips outside of Victoria between 1855–69 was made to Sydney in November 1863, where he collected plant material near Port Jackson (J. H. Willis, pers. comm.).

Europe 1869–1884

Wilhelmi remained assistant to Mueller until 1868 or possibly 1869.[8] He then returned to Europe to establish a seed shop in Dresden. However, he suffered a downturn in business. Presumably this was a result of the Franco-Prussian War of 1870–1871, and the general depression that affected Austria, Germany and Switzerland in the latter 1870s. On 25 September 1871 Wilhelmi sadly remarked that he had lost nearly all of his savings from 20 years in Australia, and might have to set up business elsewhere.[9] This does not seem to have happened as on 10 September 1873 Wilhelmi wrote to Joseph Hooker requesting that he supply him with 'the names and addresses of gentlemen situated there [London] or connected with Botanical Gardens or horticulture establishments' from whom he could obtain 'palm seeds and seeds of other decorative plants'.[10] No further details of Wilhemi's life in Europe have been located. He is known to have died at Dresden towards the end of 1884 (J. H. Willis, pers. comm.).

Collections

The majority of Wilhelmi's Australian plant collections are presumably housed in MEL with duplicates occurring in other herbaria. Some specimens are known to be housed at K [e.g. the lectotype of *Pleuropappus phyllocalymmeus* F. Muell. (Short 1983)] and E (Lamond & Bennell, this publication).

It seems that Wilhelmi, to augment his income, used to sell natural history specimens. In a letter to William Hooker on 31 December 1855, he stated:

> My collection of plants which consists of 1400 specimens, together with shells, insects etc. I shall send this month to Hamburg for sale — I should have liked to send it to England, where I might be sure of realising a better price, if I had only known anyone to send it to; Dr Mueller intended on that account to recommend me to you, but has omitted to do so on account of his sudden departure.[2]

This statement suggests that his specimens, if still extant, may be more widely dispersed than indicated above. It should also be noted that, in MEL, there are a number of collections gathered from Eyre Peninsula and seemingly attributable to Mueller.[11] Apart from the labels there is nothing to suggest[12] that he ever collected in that region (not recorded by Churchill et al. 1978) and it seems that such specimens were gathered by Wilhelmi.

General comments

Carl Wilhelmi's contributions to the natural sciences and anthropology in South Australia and Victoria from 1849 to 1869 were immense; as is evident from his list of publications (see appendix) and his large number of specimens, including many types, held at MEL. He was also the first botanist since the great Robert Brown to systematically explore and collect coastal flora on Eyre Peninsula. Similarly he was the first person to publish a detailed account of the botanical wonderland of the Grampians, Victoria. His enthusiasm for his subject and his powers of observation are self evident from the foregoing extracts from his articles and letters. And yet there is a hint of insecurity and lack of confidence in the man, albeit basking in the shadow of Ferdinand Mueller would not have helped. He certainly had his share of disappointments while residing in Australia — lack of available moneys for further investigations of the Gawler Ranges, and the cancellation of the River Darling expedition. He also seems to have been irritated that Mueller got the job of botanical collector of the Gregory expedition. Wilhelmi recorded that 'Dr Mueller advised me before he left his appointments to try and get the appointment of collector to the Expedition, but this I was obliged to forego, as he accepted it himself.'[2]

Despite all his botanical endeavour, it must have been a cruel blow when he was never offered a job as botanical collector by any of the leading botanists at Kew. In a communication to Joseph Hooker he stated:

> Had I the pleasure of seeing you at the time of my arrival in London, I could have perhaps joined, through your kind recommendation, an Expedition or Collector of Specimens of Nat. History, or as Collector of one of the large Horticultural Establishments of London, which post

I could have filled with satisfaction. Even now I would feel greatly obliged Dear Sir if you would commend me, should such an appointment offer itself.[9]

In retrospect Wilhelmi probably should never have returned to Germany: if he had stayed on in Australia who knows what botanical heights he might have accomplished.

Acknowledgements

Thanks are extended to K for the use of their letters (copyright, RBG Kew) relating to Wilhelmi: without this data my task would have been much more tedious. Tom Darragh (Melbourne) kindly furnished me with the English translation of the *Der Kosmopolit* articles for which I am most grateful. The staff at MEL, particularly Dr Jim Willis and Doris Sinkora, were unstinting in their efforts to help. The portrait of Wilhelmi was supplied by MEL. The original painting, as of Feb. 1971, was in the possession of Mrs E. Weichmann, daughter of Carl Wilhelmi.

Notes

1. Translated extract from the article in the Melbourne newspaper *Der Kosmopolit* (see Wilhelmi 1857b).
2. K correspondence to W. J. Hooker, vol. 74, no. 233. Dated 31 Dec. 1855.
3. Details of boats and passengers plying to Kangaroo Island and Eyre Peninsula for this period are seldom well documented in early newspapers. The only vessel I could locate that sailed to Port Lincoln in October or November 1854 was the schooner *Bandicoot* (Tregenza 1984). It left Port Adelaide on 26 October. It is almost certain that Wilhelmi used it for his trips to Eyre Peninsula.
4. Maiden (1907) referred to Wilhelmi as Acting Director of the Botanic Gardens during Mueller's absence. This is erroneous as the position of Director didn't exist until 1857 (Churchill *et al.* 1978).
5. K correspondence to W. J. Hooker, vol. 74, no. 234. Dated 26 June 1856.
6. K correspondence to W. J. Hooker, vol. 74, no. 235. Dated 21 May 1857.
7. K correspondence to W. J. Hooker, vol. 75, no. 243. Dated 24 November 1861.
8. It is known that he was in London on 23 May 1869 and had intended to visit Bentham at Kew. (K correspondence to Bentham, vol. 10, no. 4202.)
9. K correspondence to J. D. Hooker, vol. 140, no. 1458. Dated 25 September 1871.
10. K correspondence to J. D. Hooker, vol. 140, no. 1459. Dated 10 Sept. 1873.
11. The original description of *Lasiopetalum confertiflorum* F. Muell., *Linnaea* 25: 377 (Feb. 1853) and the three syntype specimens at MEL illustrate just why this is sometimes thought. The published data only refers to a collection gathered by Wilhelmi from Port Lincoln and the same information is provided on the syntype specimen MEL 52344. However, the two other syntypes (MEL 52345 & MEL 643215), with labels in Mueller's hand, are also signed 'Ferd. Mueller'. The specimens must have been gathered prior to Mueller's appointment as Government Botanist of Victoria on 28 Jan. 1853 and the signature on the labels is believed to indicate (D. M. Sinkora pers. comm.) that the syntype collections were part of Mueller's own herbarium — which was not presented to the Victorian Government until at least the 1860s (Willis, this publication).
12. There is no indication from shipping records that Mueller visited Eyre Peninsula.

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Wilhelmi, J. F. C. — see appendix.

Appendix

Eponymy and publications by Wilhelmi

Eponymy

Acacia wilhelmiana F. Muell., *Trans. Philos. Soc. Victoria* 1: 37 (1855). - *A. calamifolia* Sweet var. *wilhelmiana* (F. Muell.) Benth., *Fl. Austral.* 2: 339 (1864).

Lasiopetalum wilhelmii F. Muell., *Trans. Philos. Inst. Victoria* 2: 65 (1858). (= *L. macrophyllum* Grah.)

Verticordia wilhelmii F. Muell., *Trans. & Proc. Victorian Inst. Advancem Sci.* 1854–1855: 122 (1855).

Publications by Wilhelmi

1857a Notes on some edible and useful Australian plants. *Hook. J. Bot. Kew Gard. Misc.* 9: 265–267.

1857b [Lecture to Melbourne German Club.] *Der Kosmopolit (Melbourne)* p. 343 (18 Sept.), p. 347 (22 Sept.), p. 351 (25 Sept.).

1860 Manners and customs of the Australian natives, in particular of the Port Lincoln district. *Trans. Roy. Soc. Victoria* 5: 164–203.

1870 [Vortrag über . . . australische Pflanzen . . . welche als Nahrung dienen können . . .]. In V. Section für Botanik. *Sitzungs-Ber. Naturwiss. Ges. Isis Dresden* 160–163.

1871a Eine Excursion in die Grampians, Victoriagebirge und Pyrenäen von Australien. *Sitzungs-Ber. Naturwiss. Ges. Isis Dresden* 13–16.

1871b Ueber nutzbare australische Bäume, deren lokale Namen Grösse und Nutzen. *Sitzungs-Ber. Naturwiss. Ges. Isis Dresden* 100–105.

1872 [Votrag über Versandungen in Australien. . .]. *Sitzungs-Ber. Naturwiss. Ges. Isis Dresden* 146-148.

1873a [Vortrag über seine Excursion von Port Adelaide aus nach dem Murray..]. *Sitzungs-Ber. Naturwiss. Ges. Isis Dresden* 40–45.

1873b Verzeichniss extra Australischer Pflanzen. *Sitzungs-Ber. Naturwiss. Ges. Isis Dresden* 96–97.

1873c Die Pflanzen des Australischen Continentes, welche vorzugweise ihrer medicinischen Eigenschaften wegen Verwendung finden. *Sitzungs- Ber. Naturwiss. Ges. Isis Dresden* 195–197.

The contribution of the Russian botanist Turczaninov to Australian plant taxonomy

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Abstract

The Russian botanist Turczaninov was an experienced herbarium researcher before he commenced work on Australian taxa. From 1847 to 1863 he described 43 genera and approximately 400 species of Australian plants, mostly from the collections of James Drummond. These taxa were published in 15 papers, most of them in *Bull. Soc. Imp. Naturalistes Moscou.* The problems of determination of publication dates of these papers is discussed and a list of the holotype specimens housed in the Turczaninov collection of the Herbarium of the Kholodny Institute, Kiev (KW) is presented.

Nicolai Stepanovitch Turtchaninov (1796–1864), usually referred to as Turczaninov, made a substantial contribution to Australian plant taxonomy by naming 43 genera and approximately 400 species of Australian flora. A keen and gifted self-trained botanist, he amassed a large herbarium of plants from many parts of the world. His government administrative and botanical career began in St Petersburg (Leningrad) and he spent most of his life in Siberia. He never left the USSR except for extensive journeys from Siberia into the Mongolian region collecting plant specimens which he added to his herbarium or used for exchange. Through exchange and purchase he acquired his large herbarium, including some Swan River Colony collections of James Drummond and John Gilbert as well as other Australian specimens. When Turczaninov retired he devoted much of his time to preparing and publishing descriptions of new species, many of them of plants of Australian origin.

Russian taxonomic research

The Botanical Garden in St Petersburg was, during the nineteenth century, one of the leading botanical research institutes in the world. The Czar, Peter the Great (Peter the 1st), who reigned from 1682–1725, was a great patron of natural history and founded a botanic garden in Moscow in 1706 and St Petersburg in 1714 (Stapf 1913). Peter the Great initiated a long period of Siberian exploration which was supported by later Czars and Empresses of Russia.

Under Czar Alexander Ist, who ruled from 1801-1825, there was further activity in botanical science. The gardens near Moscow were destroyed by the French invasion of Napoleon in 1812 and the Czar gave his patronage to the garden in St Petersburg. Botanical exploration continued and the taxonomic activities of Fischer and Meyer established St Petersburg as an important world centre of botanical field work and taxonomic research (Bongard 1835).

F. E. L. Fischer (1782–1854) founded the Société Impériale des Naturalistes de Moscou in 1805. The bulletin of the Society, *Bull. Soc. Imp. Naturalistes Moscou*, began in 1829 (Prokhorov 1973–83, 3: 310, 17: 173). Later, as a Director of the Botanic Garden in St Petersburg, Fischer, usually known as Fischer von Waldheim, was to become a subscriber of James Drummond specimens and act as an intermediary in the exchange of plant specimens between Hooker at Kew and Turczaninov. Fischer also purchased a set of Preiss collections of W.A. plants (Fischer 1848).

Russian plant science in St Petersburg was dominated by botanists of Germanic origin until the 1850s and it was probably difficult for a native Russian like Turczaninov to practise plant taxonomy. Plant specimens from all over the world were gathered in the St Petersburg herbarium; many of these were from Australia. Familiar generic names such as *Laxmannia, Regelia* and *Siegesbeckia* were published there to commemorate Prussian or German botanists.

Nicolai Stepanovitch Turczaninov

Turczaninov was born in 1796 in Nikitovka, in the south of european Russia near the Ukranian city of Kharkov. In 1810 he attended high school and later, the University in Kharkov. He apparently developed an early love for botany and was an avid collector of plants. In 1814 he graduated from Kharkov (Prokhorov 1973–83, 26: 448) and went to St Petersburg to join the Russian civil service. He became a controller in the Ministry of Finance but kept his interest in botany, publishing a list of plants of the St Petersburg area in 1825. This must have established his botanical credentials with the notable botanists of the time.

In 1828 Turczaninov accepted an administrative post at Irkutzk in Siberia. Here he had ample opportunity to travel widely in the Lake Baikal area where he collected many specimens, sending some to St Petersburg and starting his own herbarium for private use as well as some to use for exchange at a later date. In 1830 Turczaninov was given the title of Fellow of the Imperial Botanic Garden St Petersburg as the 'travelling

scientist' responsible for the vast Siberian region between the 'Altai mountains and the eastern ocean' (Pacific). This gave him official approval to mix his botanical activities with his administrative ones, enabling him to collect specimens over a wide area.

From 1830 Turczaninov developed a collaboration with A. P. de Candolle. Correspondence preserved in Geneva, shows that de Candolle and Turczaninov exchanged many botanical specimens (Bernardi 1967). Thus the private herbarium in Irkutzk began to grow and include material from southern Asia and an area of special interest to Turczaninov, South America. In recognition of the botanical endeavours of Turczaninov, de Candolle named a new genus of Compositae *Turczaninowia* (Candolle 1836). Most western botanists submerge this with the genus *Aster*. However it is still recognized as a genus by modern Soviet taxonomists who, compared with western European botanists, have a narrower generic concept.

In 1831, 1832 and 1834 Turczaninov published papers in *Bull. Soc. Imp. Naturalistes Moscou* on the botany of Siberia and Mongolia. In 1837 he was transferred westwards to the Siberian post of Krasnioarsk as President of the Board of Provincial Governors; later he became Governor of the surrounding region. He may have returned to Moscow in Nov. 1837 for a short period (Turczaninov 1837).

In Krasnioarsk, Turczaninov started to publish *Flora Baikalensi-Dahurica* in separate parts from 1842–1857 in *Bull. Soc. Imp. Naturalistes Moscou*. Later the entire work was published in 2 volumes (Stafleau and Cowan 1986). This Flora was an enormous contribution to east Asian botany and it established Turczaninov as an experienced researcher before he started to study and describe Australian plant taxa.

At 49 years of age, in 1845, after 17 years in Siberia, Turczaninov retired and moved his substantial herbarium to Taganrog on the sea of Azov near the Black Sea (Shipchinski 1953). Taganrog had assumed importance as a port for foreign trade in the 1780s (Prokhorov 1973–83, 7: 33, 25: 317); it was probably the port of entry of many herbarium specimens en route to Moscow and handled shipping to and from South America. In Taganrog, Turczaninov fell from a herbarium ladder and fractured his leg. He became a cripple dependent on crutches and, unable to fulfil his desire to travel and collect in South America, he devoted himself to herbarium studies. By this time his herbarium included the 3rd collection of James Drummond which had been sent from the Swan River Colony in August 1844 (Erickson 1969) and Turczaninov was able to prepare his first paper describing many new Australian taxa.

In 1857, in recognition of his contribution to Russian botany, Turczaninov was awarded the prestigious Demidov prize of The Academy of Sciences of St. Petersburg (Prokhorov 1973–83, 26: 448).

Turczaninov's herbarium

In 1847 Turczaninov moved to Kharkov, accepting an offer to work in the university herbarium with his colleague Professor V. M. Czerniev. Turczaninov's extensive herbarium, which by then included many Drummond collections of Swan River plants, was also moved from Taganrog to Kharkov. It included significant numbers of South American and Indian plants as well as specimens from Mexico, the Caribbean, Africa and south-eastern and eastern Asia (Jain 1969).

The private herbarium continued to grow through exchange and purchase of advertised herbaria. For example, in 1852, while in Kharkov, Turczaninov acquired Schultes's herbarium from Munich for 3,000 Roubles (Renard in *Bull. Soc. Imp. Naturalistes Moscou* 26: 549). In 1859 he purchased a collection from Robert Brown (Renard in *Bull. Soc. Imp. Naturalistes Moscou* 32: 73) and he exchanged much material with Hooker, Bentham and others, including Steetz (Short and Sinkora 1988). His herbarium contained approximately 52,000 sheets when he transferred it to the Kharkov University in 1859 (Shipchinski 1953).

The Turczaninov herbarium was appropriated by the invading Germans in the Second World War. The whole collection was to be transported from Kharkov to Berlin but the consignment was stalled in Posnan, Poland and later returned to the Ukraine. In 1946 the non-Siberian portion went to the Herbarium of the Kholodny Institute in Kiev (Van Steenis 1950). The Turczaninov herbarium now remaining in Kharkov contains only some of Turczaninov's Siberian specimens. The Turczaninov type specimens were selected from his herbarium, mounted, numbered 1–1059, and housed separately in the Kiev Herbarium (Myakushko *et al.* 1979).

A list of the holotype specimens of Australian origin, their place of publication and collector, with the collectors number where known, is presented in Table I. Sometimes specimens additional to those listed in the protologues published by Turczaninov are included. Original spellings, including orthographic errors, have been retained in this list.

The Turczaninov type collection of Australian plants in Kiev in June 1985, consisted of 355 species mounted and in the type collection and eight species in mounted, unsorted supplementary material. During my studies I located a number of Turczaninov Australian types in the general herbarium. These were extracted and incorporated in the numbered collection and have been included in Table I. Approximately 40 type specimens of Australian taxa were not located because of insufficient time. It is likely that all could be found in the general collection. The type specimens of S. Stschegleew (Stschegl.), a student colleague of Turczaninov at Kharkov who published a number of Australian and New Zealand species in 'Descriptio Epacridearum Novarum', *Bull. Soc. Imp. Naturalistes Moscou* 32,1: 3–23, were located in the general herbarium and are now in a separate type collection.

A list of the Australian plant genera described by Turczaninov is given in Table II. This table lists the genera alphabetically, cites the reference for the original description, and gives the date of publication.

Dates of publication

In the period 1848–1855, described as the 'age of Terror of censorship' (Prokhorov 1973–83, 28: 35–6), all printed matter in Russia was required to be submitted to a board of censors for approval. This was usually done at the printers' proof stage. After printing, publications had to be approved for distribution.

Table I
Turczaninov type collections of Australian species in Kiev (KW)

Specimen number	Species[1]	Year & place of publication[2]		Collector & collection no.[3]
2	*Clematis gilbertiana*	1854	A 27(2): 273	Gilb. 62
11	*Hemistemma revolutum*	1849	A 22(2): 4	J.Dr. 3: 1
12	*Pleurandra crassifolia*	1849	A 22(2): 5	J.Dr. -: 120
13	*P. juniperina*	1849	A 22(2): 6	J.Dr. 3: 2
14	*P. mucronata*	1852	A 25(2): 139	J.Dr. 5: 290
15	*P. triandra*	1854	A 27(2): 280	Gunn s.n.
16	*P. verrucosa*	1852	A 25(2): 139	J.Dr. 5: 289
17	*Candollea helianthemoides*	1849	A 22(2): 8	J.Dr. 4: 118
18	*C. kochioides*	1849	A 22(2): 7	Gilb. 73
19	*C. teretifolia*	1849	A 22(2): 6	J.Dr. 4: 124
20	*C. tridentata*	1852	A 25(2): 140	J.Dr. 5: 288
21	*Hibbertia bracteosa*	1852	A 25(2): 140	J.Dr. 5: 287
23	*Ochrolasia drummondii*	1849	A 22(2): 3	J.Dr. -: 119
		1863	A 36(2): 549	
39	*Arabis cardamines*	1854	A 27(2): 292	J.Dr. 5: 285
43	*Cardamine paucijuga*	1854	A 27(2): 295	J.Dr. -: 131
47	*Meniocus australasicus*	1854	A 27(2): 297	J.Dr. -: 127
100	*Ionidium multiflorum*	1854	A 27(2): 340	J.Dr. 5: 72
111	*Drosera dichrosepala*	1854	A 27(2): 343	J.Dr. 5: 284
112	*D. filipes*	1854	A 27(2): 344	J.Dr. 5: 280
114	*D. platypoda*	1854	A 27(2): 343	J.Dr. 5: 281 = 231
123	*Comesperma pauciflorum*	1854	A 27(2): 352	Gilb. 86
124	*C. selaginoides*	1854	A 27(2): 352	J.Dr. -: 215
125	*C. spathulata*	1854	A 27(2): 352	Gilb. 88
				J.Dr. 5: 238
144	*Sollya parviflora*	1854	A 27(2): 361	J.Dr. 4: 99
				J.Dr. 5: 238
145	*Xerosollya gilbertii*	1854	A 27(2): 362	Gilb. 43
146	*Pronaya lanceolata*	1854	A 27(2): 364	Gilb. 66
147	*P. latifolia*	1854	A 27(2): 363	J.Dr. 5: 240
148	*P. mulleriana*	1863	A 36(1): 561	Blandowsky 58
149	*P. pedunculata*	1863	A 36(1): 560	J.Dr. s.n., 1839
150	*P. sericea*	1857	A 27(2): 363	J.Dr. 4: 97
151	*Cheiranthera filifolia*	1854	A 27(2): 364	J.Dr. 4: 94
152	*Marianthus purpureus*	1854	A 27(2): 364	J.Dr. 4: 96
156	*Frankenia bracteata*	1854	A 27(2): 368	J.Dr. -: 136
157	*F. glomerata*	1854	A 27(2): 368	J.Dr. 5: 79
158	*F. parvula*	1854	A 27(2): 368	J.Dr. 5: 81
159	*F. punctata*	1854	A 27(2): 367	J.Dr. -: 137
183	*Hibiscus drummondii*	1858	A 31(1): 192	J.Dr. 5: 90
184	*H. geraniifolius*	1858	A 31(1): 195	J.Dr. 4: 104
214	*Rulingia althaeifolia*	1852	A 25(2): 151	J.Dr. 5: 268
215	*R. cuneata*	1852	A 25(2): 151	J.Dr. 5: 271
216	*R. hexamera*	1852	A 25(2): 151	J.Dr. 5: 273
217	*R. nana*	1852	A 25(2): 150	J.Dr. 5: 270
218	*R. pauciflora*	1863	A 36(1): 570	J.Dr. 7: 99
219	*R. pulchella*	1846	A 22(2): 10	J.Dr. -: 111
				J.Dr. 7: 97
	= *Commersonia pulchella*	1846	A 19(2): 502	J.Dr. -: 111
220	*R. rotundifolia*	1852	A 25(2): 152	J.Dr. 5: 272
229	*Achilleopsis densiflora*	1849	A 22(1): 10	J.Dr. -: 100
230	*Thomasia brachystachys*	1852	A 25(2): 143	J.Dr. 5: 262
231	*T. gilbertiana*	1849	A 22(2): 10	Gilb. 82
232	*T. involucrata*	1852	A 25(2): 143	J.Dr. 5: 255
233	*T. rhyncocarpa*	1852	A 25(2): 142	J.Dr. 5: 261
234	*T. rugosa*	1846	A 19(2): 501	J.Dr. -: 105
235	*T. sarotes*	1852	A 25(2): 145	J.Dr. 5: 256
236	*Ditomostrophe angustifolia*	1846	A 19(2): 499	J.Dr. -: 102
237	*Thomasia triloba*	1846	A 19(2): 500	J.Dr. -: 106
238	*Lasiopetalum acutiflorum*	1852	A 25(2): 145	J.Dr. 5: 254
239	*L. capitellatum*	1852	A 25(2): 148	J.Dr. 5: 263
240	*L. stelligerum*	1852	A 25(2): 147	J.Dr. 5: 257
241	*L. quinquenervium*	1852	A 25(2): 146	J.Dr. 5: 260
242	*Asterochiton pygmaeus*	1852	A 25(2): 138	J.Dr. 5: 258
243	*Corethrostylis microphylla*	1852	A 25(2): 148	J.Dr. -: 259
				Gilb. 83
244	*Sarotes latifolia*	1852	A 25(2): 150	J.Dr. 5: 265
245	*S. rosmarinifolia*	1852	A 25(2): 149	J.Dr. 5: 266
246	*Actinostigma lanceolatum*	1859	A 32(1): 259	Brogden s.n.
386	*Dodonea inaequifolia*	1858	A 31(1): 408	J.Dr. 4: 258
387	*D. larreoides*	1858	A 31(1): 408	J.Dr. 3: 213
388	*D. ptarmicaefolia*	1852	A 25(2): 155	J.Dr. 5: 248
416	*Pelargonium drumondii*	1858	A 31(1): 421	J.Dr. 5: 191
465	*Zygophyllum terminale*	1858	A 31(1): 437	J.Dr. -: 90
468	*Nematolepis phebalioides*	1852	A 25(2): 158	J.Dr. 5: 194

Specimen number	Species[1]	Year & place of publication[2]		Collector & collection no.[3]
469	*Phebalium filifolium*	1852	A 25(2): 159	J.Dr. 5: 206
470	*P. microphyllum*	1852	A 25(2): 159	J.Dr. 5: 208
471	*P. umbellatum*	1849	A 22(2): 15	J.Dr. 5: - Stephenson s.n. Cunn., 1836
472	*Crowea augustifolia*	1849	A 22(2): 13	J.Dr. 3: 12
473	*Eriostemon calycinum*	1849	A 22(2): 14	J.Dr. 4: 93
474	*E. effusum*	1849	A 22(2): 14	Gilb. 95
475	*Geleznowia verrucosa*	1849	A 22(2): 13	J.Dr. 3: 8
476	*Philotheca longifolia*	1849	A 32(2): 16	Stephenson s.n.
477	*Boronia bicolor*	1852	A 25(2): 163	J. Dr. 5: 200
478	*B. calophylla*	1852	A 25(2): 160	J.Dr. 5: 205
479	*B. inornata*	1852	A 25(2): 164	J.Dr. 5: 197
480	*B. leptophylla*	1852	A 25(2): 164	J.Dr. 5: 196
481	*B. oxyantha*	1852	A 25(2): 165	J.Dr. 5: 198
482	*B. thymifolia*	1852	A 25(2): 165	J.Dr. 5: 195
483	*Microcybe albiflora*	1852	A 25(2): 167	J.Dr. 5: 210
484	*M. multiflora*	1852	A 25(2): 166	J.Dr. 5: 211
485	*M. pauciflora*	1852	A 25(2): 167	J.Dr. 5: 209
537	*Cryptandra cordata*	1858	A 31(1): 459	J.Dr. 5: 230
538	*C. microcephala*	1858	A 31(1): 458	J.Dr. 5: 234
539	*C. parvifolia*	1858	A 31(1): 459	J.Dr. 4: 156
540	*C. pauciflora*	1858	A 31(1): 459	J.Dr. 5: 233
541	*C. villosa*	1858	A 31(1): 458	J.Dr. 5: 232
542	*Trymalium oligocephalum*	1858	A 31(1): 460	J.Dr. 5: 236
543	*T. polycephalum*	1858	A 31(1): 460	J.Dr. 5: 91
544	*T. thomasioides*	1858	A 31(1): 459	J.Dr. 5: 231
589	*Callistachys tetragona*	1853	A 26(1): 249	J.Dr. 3: 83
590	*Oxylobium atropurpureum*	1853	A 26(1): 250	J.Dr. 5: 53
591	*Isotropis juncea*	1853	A 26(1): 251	J.Dr. -: 22
592	*Kalcniczenkia daviesioides*	1853	A 26(1): 252	J.Dr. -: 26
593	*Choriscma capillipes*	1853	A 26(1): 255	J.Dr. 5: 27
594	*C. cytisoides*	1853	A 26(1): 256	J.Dr. 5: 77
595	*C. denticulatum*	1853	A 26(1): 252	J.Dr. 5: 25
595a	*C. trigonum*	1853	A 26(1): 254	J.Dr. 5: 22
595b	*C. heterophyllum*	1853	A 26(1): 255	J.Dr. 5: 27
596	*C. humile*	1853	A 26(1): 254	J.Dr. 4: 36
597	*C. parvifolium*	1853	A 26(1): 253	J.Dr. 5: 23
598	*C. pubescens*	1853	A 26(1): 256	J.Dr. 4: 33
599	*Piptomeris aphylla*	1853	A 26(1): 258	J.Dr. 5: 24, ?= 5: 32
600	*Gompholobium obcordatum*	1853	A 26(1): 258	J.Dr. 5: 42
601	*Leptocytisus hirtellus*	1853	A 26(1): 258	J.Dr. 5: 72
602	*Jacksonia compressa*	1853	A 26(1): 260	J.Dr. 5: 36
603	*J. foliosa*	1853	A 26(1): 260	J.Dr. 4: 25
604	*J. grevilleoides*	1853	A 26(1): 259	J.Dr. 4: 32
605	*J. juncea*	1853	A 26(1): 261	J.Dr. 5: 33
606	*J. umbellata*	1853	A 26(1): 261	J.Dr. 5: 34
607	*Daviesia acanthoclada*	1853	A 26(1): 262	J.Dr. 5: 90
608	*D. anceps*	1853	A 26(1): 266	J.Dr. 5: 86
609	*D. calystegia*	1853	A 26(1): 264	J.Dr. 4: 30
610	*D. condensata*	1853	A 26(1): 265	J.Dr. 5: 50
611	*D. crenulata*	1853	A 26(1) :265	J.Dr. 5: 40
612	*D. lancifolia*	1853	A 26(1): 263	J.Dr. 4: 28
613	*D. mollis*	1853	A 26(1): 263	J.Dr. 5: 39
614	*D. obovata*	1853	A 26(1): 261	J.Dr. 5: 41
615	*D. pachylima*	1853	A 26(1): 263	Gilb. 252 J.Dr. 5: 43
616	*D. striata*	1853	A 26(1): 264	J.Dr. 4: 29
617	*Sphaerolobium daviesioides*	1853	A 26(1): 266	J.Dr. 5: 46
618	*S. drumondii*	1853	A 26(1): 267	J.Dr. 5: 47 p.p.
619	*Phyllota gracilis*	1853	A 26(1): 267	J.Dr. 3: 91
620	*P. villosa*	1853	A 26(1): 267	Gilb. 255
621	*Urodon capitatus*	1849	A 22(2): 17	J.Dr. 4: 21
622	*U. dasyphyllus*	1853	A 26(1): 268	J.Dr. 5: 47 p.p.
623	*Aotus genistoides*	1853	A 26(1): 268	J.Dr. 5: 61
624	*Eutaxia densifolia*	1853	A 26(1): 271	J.Dr. 5: 76
625	*E. leptophylla*	1853	A 26(1): 268	J.Dr. 4: 35
626	*E. obovata*	1853	A 26(1): 271	J.Dr. 5: 46
627	*E. punctata*	1853	A 26(1): 272	J.Dr. 5: 69
628	*E. uncinata*	1853	A 26(1): 269	J.Dr. 5: 49
629	*E. divaricata*	1853	A 26(1): 270	J.Dr. 4: 23
630	*Gastrolobium corymbosum*	1853	A 26(1): 272	J.Dr. 5: 58
631	*G. crenulatum*	1853	A 26(1): 273	J.Dr. 5: 55
632	*G. emarginatum*	1853	A 26(1): 273	J.Dr. 5: 51
633	*G. polycephalum*	1853	A 26(1): 274	J.Dr. 5: 54
634	*G. pulchellum*	1853	A 26(1): 274	J.Dr. 5: 57
635	*G. stenophyllum*	1853	A 26(1): 275	J.Dr. 5: 52
636	*Euchilus calycinus*	1853	A 26(1): 276	J.Dr. 5: 75

Specimen number	Species[1]	Year & place of publication[2]		Collector & collection no.[3]
637	*E. purpureus*	1853	A 26(1): 276	J.Dr. 5: 70
638	*E. rotundifolius*	1853	A 26(1): 277	J.Dr. 5: 78
639	*E. spinulosus*	1853	A 26(1): 275	J.Dr. 5: 71
640	*Pultenaea adunca*	1853	A 26(1): 279	J.Dr. 5: 66
641	*P. brachyphylla*	1853	A 26(1): 279	J.Dr. 5: 68
642	*P. diemenica*	1853	A 26(1): 277	Gunn s.n.
643	*P. neurocalyx*	1853	A 26(1): 281	J.Dr. 5: 63
644	*P. pteronioides*	1853	A 26(1): 280	J.Dr. 5: 67
645	*P. verruculosa*	1853	A 26(1): 278	J.Dr. 5: 65
646	*P. verticillata*	1853	A 26(1): 279	J.Dr. 5: 64
647	*Mirbelia aspera*	1853	A 26(1): 281	J.Dr. 5: 28
648	*M. racemosa*	1853	A 26(1): 282	J.Dr. 5: 59
649	*M. subcordata*	1853	A 26(1): 282	J.Dr. 5: 60
650	*Dichosema microphyllum*	1853	A 26(1): 283	J.Dr. 5: 85
651	*D. multicaule*	1853	A 26(1): 283	J.Dr. 4: 34
652	*Platylobium spinosum*	1853	A 26(1): 284	J.Dr. 5: 84
653	*Bossiaea divaricata*	1853	A 26(1): 285	J.Dr. 5: 83
654	*B. gilbertii*	1853	A 26(1): 286	Gilb. 313
655	*B. oxyclada*	1853	A 26(1): 284	J.Dr. 5: 82
656	*B. peduncularis*	1853	A 26(1): 287	J.Dr. 5: 80
657	*B. rigida*	1853	A 26(1): 285	J.Dr. 5: 79
677	*Actinodium proliferum*	1849	A 22(2): 17	J.Dr. -: 44
678	*Genetyllis agathosmoides*	1852	B 10: 322	J.Dr. 5: 103
679	*G. hypericifolia*	1852	B 10: 323	J.Dr. 5: 98
680	*G. lejostyla*	1852	B 10: 323	J.Dr. 5: 101
681	*G. macrostegia*	1849	A 22(2): 18	J.Dr. -: 40
				J.Dr. 5: 97
682	*G. oederioides*	1849	A 22(2): 18	J.Dr. -: 41
682	*G. oxylepis*	1852	B 10: 324	J.Dr. 5: 100
683	*G. squarrosa*	1852	B 10: 323	J.Dr. 5: 99
684	*Paryphantha cuspidata*	1852	B 10:321	J.Dr. 5: 24
685	*Darwinia brevistyla*	1847	A 20(1): 155	J.Dr. 3: 23
686	*D. saturejaefolia*	1852	B 10: 324	J.Dr. 4: 42
687	*Decalophium darwinioides*	1852	B 10: 326	J.Dr. 5: 106
688	*D. juniperinum*	1852	B 10: 325	J.Dr. 5: 104
689	*D. melaleucum*	1852	B 10: 325	J.Dr. 5: 105
690	*D. micranthum*	1852	B 10: 326	J.Dr. 5: 22
691	*D. pauciflorum*	1847	A 20(1): 154	J.Dr. -: 31
		1852	B 10: 325	J.Dr. 3: 31
692	*D. rugulosum*	1852	B 10: 326	J.Dr. 4: 45
	= *Genetyllis pauciflora*	1849	A 22(2): 17	
693	*Thryptomene hyporhytis*	1862	A 35(2): 324	J.Dr. 7: 63
694	*T. mucronulata*	1847	A 20(1): 156	J.Dr. -: 33
695	*T. obovata*	1852	B 10: 322	J.Dr. 5: 23
696	*T. prolifera*	1862	A 35(2): 324	J.Dr. 7: 62
697	*T. racemulosa*	1847	A 20(1): 156	J.Dr. -: 32
698	*Verticordia brachypoda*	1847	A 20(1): 158	J.Dr. -: 28
				Gilb. 30
699	*V. carinata*	1849	A 22(2): 19	J.Dr. -: 46
700	*V. cespitosa*	1847	A 20(1): 157	Gilb. 330
701	*V. fastigiata*	1852	B 10: 327	J.Dr. 5: 114
702	*V. fimbrilepis*	1847	A 20(1): 158	J.Dr. -: 24
703	*V. fimbripetala*	1849	A 22(2): 19	J.Dr. 4: 47
				J.Dr. 5: 111
704	*V. gilbertii*	1847	A 20(1): 160	Gilb. 11
				Gilb. 13
705	*V. hirta*	1852	B 10: 327	J.Dr. 5: 112
706	*V. monadelpha*	1847	A 20(1): 158	J.Dr. -: 27
707	*V. multiflora*	1847	A 20(1): 159	J.Dr. -: 26
708	*V. oxylepis*	1852	B 10: 327	J.Dr. 5: 113
709	*V. pectinata*	1852	B 10: 327	J.Dr. 5: 110
710	*V. pentandra*	1847	A 20(1): 157	Gilb. 329
711	*V. stylosa*	1847	A 20(1): 160	Gilb. 327
712	*V. umbellata*	1847	A 20(1): 159	J.Dr. -: 25
				J.Dr. 5: 108
				J.Dr. 5: 109
713	*Lhotzkya scabra*	1862	A 35(2): 324	Gilb. 186, ?= 126
714	*Calycothrix cuspidata*	1847	A 20(1): 162	Gilb. 333
				Gilb. 335
715	*C. depressa*	1847	A 20(1): 162	J.Dr. -: 24
716	*C. diversifolia*	1852	B 10: 328	J.Dr. 5: 116 p.p.
717	*C. pulchella*	1852	B 10: 328	J.Dr. 5: 115
718	*C. tenuiramea*	1849	A 22(2): 20	J.Dr. -: 50
719	*Tetrapora glomerata*	1852	B 10: 329	J.Dr. 5: 117
720	*T. verrucosa*	1852	B 10: 329	J.Dr. 5: 137
721	*Harmogia leptophylla*	1852	B 10: 330	J.Dr. 3: 35 p.p.
				J.Dr. 3: 37
722	*H. parviflora*	1852	B 10: 330	J.Dr. 5: 25

Specimen number	Species[1]	Year & place of publication[2]		Collector & collection no.[3]
723	*H. serpyllifolia*	1852	B 10: 330	J.Dr. 3: 38
724	*Rinzia crassifolia*	1852	B 10: 331	J.Dr. 5: 122
725	*R. longifolia*	1852	B 10: 331	J.Dr. 5: 121
726	*R. oxycoccoides*	1852	B 10: 331	J.Dr. 5: 120
727	*Cyathostemon tenuifolius*	1852	B 10: 332	J.Dr. 5: 123
728	*Anticoryne diosmoides*	1852	B 10: 332	J.Dr. 5: 124
729	*Hypocalymma ciliatum*	1862	A 35(2): 325	J.Dr. 7: 66
730	*H. cuneatum*	1862	A 35(2): 325	J.Dr. 7: 67
731	*H. linifolium*	1862	A 35(2): 325	J.Dr. 7: 65
732	*H. myrtifolium*	1852	B 10: 333	J.Dr. 5: 118
733	*H. speciosum*	1852	B 10: 332	J.Dr. 5: 119
734	*H. tetrapterum*	1862	A 35(2): 325	J.Dr. 7: 68
735	*Astartea clavulata*	1852	B 10: 333	J.Dr. 5: 128
736	*Agonis floribunda*	1849	A 22(2): 20	J.Dr. -: 56
737	*A. glabra*	1852	B 10: 334	J.Dr. 5: 132
738	*Pericalymma roseum*	1852	B 10: 334	J.Dr. 5: 135
739	*P. teretifolium*	1852	B 10: 334	J.Dr. 5: 134
740	*Leptospermum incanum*	1852	B 10: 335	J.Dr. 5: 130
741	*Leptospermum nitens*	1852	B 10: 335	J.Dr. 5: 28
742	*L. oligandrum*	1852	B 10: 335	J.Dr. 5: 129
743	*Kunzea hirsuta*	1862	A 35(2): 326	Brogden s.n.
744	*K. oligandra*	1852	B 10: 336	J.Dr. 5: 139
745	*K. sericea*	1847	A 20(1):162	J.Dr. -: 40
746	*K. sprengelioides*	1852	B 10: 336	J.Dr. 5: 138
747	*K. squarrosa*	1852	B 10: 335	J.Dr. 5: 136 J.Dr. 5: 137
748	*Piptandra spatulata*	1862	A 35(2): 324	J.Dr. 7: 59
749	*Eucalyptus acutangula*	1852	B 10: 338	J.Dr. 5: 189
750	*E. angustifolia*	1852	B 10: 337	J.Dr. 5: 33
751	*E. brachypoda*	1849	A 22(2): 21	J.Dr. 4: 73
752	*E. calycogona*	1852	B 10: 338	J.Dr. 5: 184
753	*E. celastroides*	1852	B 10: 338	J.Dr. 5: 34
754	*E. cuspidata*	1849	A 22(2): 21	J.Dr. 4: 75
755	*E. erythronema*	1852	B 10: 337	J.Dr. -: 37
756	*E. falcata*	1847	A 20(1): 163	J.Dr. -: 70
757	*E. gonianthia*	1847	A 20(1): 163	J.Dr. -: 71
758	*E. pruinosa*	1849	A 22(2): 23	J.Dr. 4: 70
759	*E. macrocera*	1849	A 22(2): 20	J.Dr. 4: 67
760	*E. obcordata*	1852	B 10: 337	J.Dr. 5: 183
761	*E. pyriformis*	1849	A 22(2): 22	J.Dr. 4: 69
762	*E. tetraptera*	1849	A 22(2): 22	J.Dr. 4: 17
763	*E. uncinata*	1849	A 22(2): 23	J.Dr. -: 66 J.Dr. -: 76
764	*E. xanthonema*	1847	A 20(1): 163	J.Dr. -: 67
765	*Melaleuca adnata*	1852	B 10: 343	J.Dr. 5: 160
766	*M. angulata*	1852	B 10: 342	J.Dr. 5: 161
767	*M. apodocephala*	1852	B 10: 340	J.Dr. 5: 168
768	*M. blaeriaefolia*	1847	A 20(1): 165	J.Dr. -: 45
769	*M. bracteosa*	1852	B 10: 340	J.Dr. 5: 159
770	*M. brevifolia*	1852	B 10: 342	J.Dr. 5: 164
771	*M. canaliculata*	1852	B 10: 342	J.Dr. 5: 152
772	*M. carinata*	1852	B 10: 344	J.Dr. 5: 165
773	*M. ciliosa*	1862	A 35(2): 326	J.Dr. 7: 76
774	*M. citrina*	1852	B 10: 341	J.Dr. 5: 148
775	*M. concinna*	1852	B 10: 339	J.Dr. 5: 172
776	*M. cordata*	1852	B 10: 339	J.Dr. 5: 31
777	*M. cucullata*	1852	B 10: 343	J.Dr. 5: 151
779	*M. cuneata*	1852	B 10: 339	J.Dr. 5: 30
780	*M. cuspidata*	1862	A 35(2): 327	J.Dr. 7: 77
781	*M. cyrtodonta*	1849	A 22(2): 24	J.Dr. 4: 65
782	*M. depauperata*	1852	B 10: 343	J.Dr. 5: 153
783	*M. divaricata*	1852	B 10: 344	J.Dr. 5: 144
784	*M. epacridioides*	1847	A 20(1): 165	J.Dr. 3: 46 J.Dr. 5: 149
785	*M. erucaeformis*	1852	B 10: 344	J.Dr. 5: 166 J.Dr. 5: 167
786	*M. hamulosa*	1847	A 20(1): 165	J.Dr. -: 44
787	*M. lateralis*	1852	B 10: 339	J.Dr. 5: 162
788	*M. laxiflora*	1852	B 10: 341	J.Dr. 5: 142
789	*M. macronychia*	1852	B 10: 340	J.Dr. 5: 32
790	*M. nummularia*	1832	B 10: 341	J.Dr. 5: 140
790a	*M. pauciflora*	1847	A 20(1): 166	Gilb. 40
791	*M. pinifolia*	1847	A 20(1): 166	Gilb. 87
792	*M. rigidifolia*	1852	B 10: 342	J.Dr. -: 176
793	*M. serpyllifolia*	1852	B 10: 339	J.Dr. 5: 175
794	*M. sparsiflora*	1847	A 20(1): 167	J.Dr. -: 50
795	*M. subfalcata*	1852	B 10: 341	J.Dr. 5: 150

Specimen number	Species[1]	Year & place of publication[2]		Collector & collection no.[3]
796	*Regelia adpressa*	1849	A 22(2): 25	J.Dr. 4: 63
797	*R. gibbosa*	1847	A 20(1): 168	J.Dr. -: 55
798	*Beaufortia heterophylla*	1852	B 10: 345	J.Dr. 5: 174
799	*B. microphylla*	1849	A 22(2): 24	J.Dr. 4: 64
800	*B. puberula*	1852	B 10: 345	J.Dr. 5: 173
801	*B. velutina*	1852	B 10: 345	J.Dr. 5: 179
802	*Calothamnus affinis*	1852	B 10: 346	J.Dr. 5: 182
803	*C. aspera*	1849	A 22(2): 25	J.Dr. 4: 60
804	*C. nodosa*	1847	A 20(1): 168	J.Dr. -: 60
805	*Punieella carinata*	1852	B 10: 333	J.Dr. 5: 26
		1852	A 26(1): 287	J.Dr. -: 2
806	*Trichobasis aurea*	1852	B 10: 337	J.Dr. 5: 147
811a	*Hydroeotyle medicaginoides*	1849	A 22(2): 27	J.Dr. 4: 144
812	*H. pilifera*	1849	A 22(2): 26	J.Dr. s.n., 1839
813	*H. rugulosa*	1849	A 22(2): 27	J.Dr. 4: 146
814	*H. verticillata*	1849	A 22(2): 28	J.Dr. 4: 145
815	*Dimetopia anisoearpa*	1849	A 22(2): 2	J.Dr. 4: 132
816	*D. grandis*	1849	A 22(2): 29	J.Dr. 4: 133
817	*Platysace flexuosa*	1849	A 22(2): 29	J.Dr. 4: 138
818	*Traehymene commutata*	1849	A 22(2): 30	J.Dr. -: 229
				J.Dr. 4: 136
819	*T. deflexa*	1849	A 22(2): 31	J.Dr. 4: 137
820	*T. effusa*	1849	A 22(2): 31	J.Dr. 4: 135
821	*Xanthosia rhomboidea*	1849	A 22(2): 32	J.Dr. 4: 134
822	*X. villosa*	1849	A 22(2): 32	J.Dr. 4: 139, ?= 133
849a	*Diplopappus australasicus*	1851	A 24(1): 171	J.Dr. 4: 218
				J.Dr. 5: 373
850	*Eurybia imbrieata*	1851	A 24(2): 61	J.Dr. 5: 370
850a	*Diplopappus passerinoides*	1851	A 24(2): 62	J.Dr. 5: 371
851	*Eurybia leptophylla*	1851	A 24(1): 171	J.Dr. -: 127
853	*Erigeron liatroides*	1851	A 24(1): 172	J.Dr. 4: 222, ?= 122
855	*Goniopogon multicaule*	1851	A 24(1): 173	J.Dr. 4: 215, ?= 115
856	*Isoetopsis graminifolia*	1851	A 24(1): 174	J.Dr. 5: 390
				J.Dr. 4: 207
857	*Brachyeome paehyptera*	1851	A 24(1): 175	J.Dr. 4: 205
858	*B. tenella*	1851	A 24(1): 176	J.Dr. 4: 208
868a	*Ceratogyne obionoides*	1851	A 24(2): 69	J.Dr. 5: 56
882	*Epitriehe cuspidata*	1851	A 24(2): 75	J.Dr. 5: 58
883	*Chrysoeoryne uniflora*	1851	A 24(1): 188	J.Dr. -: 116
884	*Piptostemma earpesioides*	1851	A 24(1): 192	J.Dr. 4: 200
885	*Pachysurus multiflorus*	1851	A 24(1): 192	J.Dr. -: 117
				J.Dr. 5: 389
885a	*Skirrhophorus drummondii*	1851	A 24(1): 188	J.Dr. -: 123
885b	*S. mueronulatus*	1851	A 24(2): 72	J.Dr. 5: 59
886	*Waitzia dasycarpa*	1851	A 24(2): 77	J.Dr. 5: 65 p.p.
887	*W. discolor*	1851	A 24(2): 194	J.Dr. 4: 198
				J.Dr. s.n., 1848
888	*W. odontolepis*	1851	A 24(2): 77	J.Dr. 5: 382
889	*Podolepis gilbertii*	1851	A 24(1): 195	J.Dr. 5: 386
				Gilb. 269
				Gilb. 282
890	*P. pallida*	1851	A 24(2): 78	J.Dr. 5: 387
891	*Ozothamnus tephrodes*	1851	A 24(2): 79	J.Dr. 5: 385
893	*Helichrysum ambiguum*	1851	A 24(1): 195	J.Dr. 3: 121
				J.Dr. 4: 220
895	*Chrysocephalum eanescens*	1851	A 24(1): 196	Gilb. 285
896	*C. glabratum*	1851	A 24(1): 197	J.Dr. -: 115
897	*Helipterum fuscescens*	1851	A 24(2): 80	J.Dr. 5: 64
898	*H. heteranthum*	1851	A 24(1): 198	J.Dr. 4: 214
899	*H. pusillum*	1851	A 24(2): 80	J.Dr. 5: 384
900	*H. tenellum*	1851	A 24(1): 198	Gilb. 272
901	*Xanthochrysum filifolium*	1851	A 24(1): 199	J.Dr. -: 119
902	*Trichostegia asteroides*	1851	A 24(2): 81	J.Dr. 5: 66
904	*Gnaphalium sericeum*	1851	A 24(2): 83	J.Dr. 5: 392
905	*Argyroglottis turbinata*	1851	A 24(2): 84	J.Dr. 5: 63
908	*Erechtites ineana*	1851	A 24(2): 85	J.Dr. 5: 379
909	*E. picridioides*	1851	A 24(1): 200	J.Dr. -: 132
923	*Senecio barkhausioides*	1851	A 24(2): 86	J.Dr. 5: 378
927	*S. gilbertii*	1851	A 24(1): 208	Gilb. 289
939	*Tripteris atropurpurea*	1851	A 24(1): 212	J.Dr. -: 131
1001	*Physopsis spicata*	1849	A 22(2): 34	J.Dr. 4: 235, ?= 234
1002	*Quoya racemosa*	1863	A 36(2): 194	J.Dr. 3: 141
				J.Dr. 5: 73
1041	*Pityrodia drummondii*	1863	A 36(2): 213	J.Dr. 7: 141
1042	*Cyanostegia angustifolia*	1849	A 22(2): 36	J.Dr. -: 140
1043	*C. intermedia*	1849	A 22(2): 36	J.Dr. -: 161
1044	*C. lanceolata*	1849	A 22(2): 35	J.Dr. -: 139

Specimen number	Species[1]	Year & place of publication[2]		Collector & collection no.[3]
1058	*Lachnocephalus lepidotus*	1849	A 22(2): 36	J.Dr. 4: 235 Gilb. 6
1155	*Diplopappus glandulosus*	1851	A 24(2): 62	J.Dr. 5: 69
1059	*Pycnolachne ledifolia*	1863	A 36(2): 215	J.Dr. 7: 220
Supplementary type collection				
4.15	*Lepidium drummondii*			
11.38	*Guichenotia macrantha*			
11.45	*Rulingia crispa* [= *Commersonia crispa*]			
12.50	*Tetratheca pubescens*			
12.51	*Tetratheca tenuiramea*			
27.178	*Astartea muriculata*			
27.180	*Calothamnus plumosa*			
27.183	*Decalophium cornigerum*			
27.184	*Genetyllis drumondii*			
27.193	*Melaleuca thyoides*			

1 Original spellings
2 A = *Bull. Soc. Imp. Naturalistes Moscou*; B = *Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg*
3 Cunn. = Allan Cunningham (1791–1839); Gilb. = John Gilbert (1810–1845); J. Dr. = James Drummond (1784–1863)

All except one of Turczaninov's fifteen papers describing new plants from Australia were published in *Bull. Soc. Imp. Naturalistes Moscou*. Papers were first communicated to the Society, submitted for publication, typeset and then submitted to the censor for approval.

On the verso of the title page of each number of the *Bull. Soc. Imp. Naturalistes Moscou* is a stamp giving official approval to proceed with publication. This stamp, in Russian, is translated as:

> 'Printing permitted, with the condition that after printing, the required number of copies are presented to the Censorship Committee.
> Moscow............Date............Censor(s)'

Thus the censor's date gives a clue to publication date. But clearly the best evidence for publication date would be the day on which copies were approved by the Censorship Committee for distribution. This latter information has been searched for in the Lenin Library, Moscow and archival institutes in Leningrad without success.

The Société Impériale des Naturalistes de Moscou met every four or five weeks, on a Saturday, with an annual summer break of four or five months from May to August or September. At each meeting there was usually an announcement of papers accepted or offered for publication. Because Turczaninov did not live near Moscow this was done by correspondence. Announcements of forthcoming publications were printed in the proceedings, the Séances (meetings), published in *Bull. Soc. Imp. Naturalistes Moscou*.

The Séances also contained announcements made by the First Secretary of the Society (Renard, at the time of the Turczaninov publications), on the publication of the various numbers of the *Bull. Soc. Imp. Naturalistes Moscou*. Each volume of the bulletin consists of two parts; part 1 has numbers 1 and 2 and part 2 has numbers 3 and 4. When these were published Renard made an announcement at a meeting and this was published in the bulletin. Thus, the date of presentation of a number or part of a volume by Renard is also an indication of publication date of the parts and numbers of the bulletin.

The dates published in the bulletin and the date of the censor stamp are apparently in the Julian calendar. Russia did not change to the Gregorian calendar until 1917 and it is necessary to add 12 days after the year 1800 to convert from the Julian to the Gregorian calendar. The *Bull. Soc. Imp. Naturalistes Moscou* sometimes cites both calendars and some meteorological papers have Gregorian dates, however it is almost certain that the censor dates are in Julian and it is reasonable to conclude that the dates cited in the Séances are also in that calendar.

In Kew the correspondence of Hooker and Bentham contains a letter from Renard in Moscow to W. J. Hooker concerning *Bull. Soc. Imp. Naturalistes Moscou* 1843, numbers 2 and 3 (Renard 1843). These were sent to Hooker from Moscow dated 18/30 Sept. 1843 (the first date is according to the Julien calendar, the second to the Gregorian). Information on the date of censor approval and announcement by the First Secretary of the Society of these journal parts is as follows (Renard, *Bull. Soc. Imp. Naturalistes Moscou* 16: 808):

	Censor approval	Publication presented by Renard
1843 No 2	28 March 1843	16 Sept. 1843
No 3	13 June 1843	16 Sept. 1843

Thus the date presented by Renard is only 2 days before a copy was addressed to Hooker. It seems that the date of presentation by Renard is the best available indicator of publication date except for those papers printed in the summer holiday break of four or five months. Table III presents details of the fourteen papers of Turczaninov with Australian taxa published in *Bull. Soc. Imp. Naturalistes Moscou*. The year, volume, part, number and pagination are listed for each publication. In addition the table gives the date of censor approval, date of mention in the Society Séances, the date the number was presented to the Société Impériale des Naturalistes de Moscou by Renard, and the 'established' publication date. This information has been gathered from a survey of *Bull. Soc. Imp. Naturalistes Moscou* from 1845 to 1864.

A publication of Turczaninov which poses no problem for dating was printed in 1852 in the St Petersburg journal, *Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg* 10: 322–346. The paper is titled 'Myr-

Table II
Australian plant genera described by Turczaninov*

Genus	Publication
Achilleopsis	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 9 (1849)
Actinostigma	*Bull Soc. Imp. Naturalistes Moscou* 32(1): 259 (1859)
Anticoryne	*Bull Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pètersbourg* 10: 332 (1852)
Argyroglottis	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 83 (1851)
Asterochiton	*Bull Soc. Imp. Naturalistes Moscou* 25(2): 138 (1852)
Ceratogyne	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 68 (1851)
Cyanostegia	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 35 (1849)
Cyathostemon	*Bull Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pètersbourg* 10: 331 (1852)
Decalophium	*Bull Soc. Imp. Naturalistes Moscou* 20(1): 153 (1847)
Ditomostrophe	*Bull Soc. Imp. Naturalistes Moscou* 19(2): 498 (1847)
Epitriche	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 74 (1851)
Ericomyrtus	*Bull Soc. Imp. Naturalistes Moscou* 20(1): 154 (1847)
Gamozygis	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 75 (1851)
Geleznowia	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 12 (1849)
Gilberta	*Bull Soc. Imp. Naturalistes Moscou* 24(1): 192 (1851)
Gomotriche	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 37 (1849)
Goniopogon	*Bull Soc. Imp. Naturalistes Moscou* 24(1): 173 (1851)
Gonostegia	*Bull Soc. Imp. Naturalistes Moscou* 19(2): 509 (1847)
Gyrostephium	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 76 (1851)
Hexagonotheca	*Bull Soc. Imp. Naturalistes Moscou* 19(2): 505 (1847)
Isoetopsis	*Bull Soc. Imp. Naturalistes Moscou* 24(1): 174 (1851)
Kaleniczenkia	*Bull Soc. Imp. Naturalistes Moscou* 26(1): 252 (1853)
Lachnocephalus	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 36 (1849)
Leptotriche	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 73 (1851)
Macrostegia	*Bull Soc. Imp. Naturalistes Moscou* 25(2): 177 (1852)
Meladenia	*Bull Soc. Imp. Naturalistes Moscou* 21(1): 576 (1848)
Microcybe	*Bull Soc. Imp. Naturalistes Moscou* 25(2): 166 (1852)
Nematolepis	*Bull Soc. Imp. Naturalistes Moscou* 25(2): 158 (1852)
Ochrolasia	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 3 (1849)
Pentaptelion	*Bull Soc. Imp. Naturalistes Moscou* 36(2): 193 (1863)
Physopsis	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 34 (1849)
Piptandra	*Bull Soc. Imp. Naturalistes Moscou* 35(2): 323 (1863)
Piptomeris	*Bull Soc. Imp. Naturalistes Moscou* 26(1): 257 (1853)
Piptostemma	*Bull Soc. Imp. Naturalistes Moscou* 24(1): 191 (1851)
Punicella	*Bull Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pètersbourg* 10: 333 (1852)
Pycnolachne	*Bull Soc. Imp. Naturalistes Moscou* 36(2): 214 (1863)
Toxanthes	*Bull Soc. Imp. Naturalistes Moscou* 24(1): 176 (1851)
Trichobasis	*Bull Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pètersbourg* 10: 336 (1852)
Trichostegia	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 81 (1851)
Triptilodiscus	*Bull Soc. Imp. Naturalistes Moscou* 24(2): 66 (1851)
Urodon	*Bull Soc. Imp. Naturalistes Moscou* 22(2): 16 (1849)
Xanthochrysum	*Bull Soc. Imp. Naturalistes Moscou* 24(1): 199 (1851)
Xerosollya	*Bull Soc. Imp. Naturalistes Moscou* 27(2): 362 (1855)

* The volume number and part number 1 or 2 is given as well as the page reference. The date is the date of publication, not the date of the journal.

Table III
Turczaninov publications of Australian plants in *Bull. Soc. Imp. Naturalistes Moscou**

year	vol.	part	no.	pages	censor approval	presented at Séance	presented by Renard	'established' publ. date
1846	19	2	4	497–510	18 Sept.1846	19 Sept. 1846	16 Jan. 1847	28 Jan. 1847
1847	20	1	1	148–174	7 March 1847	13 March 1847	—	March 1847
1849	22	2	3	3–38	15 July 1849	24 Feb. 1849	20 Oct. 1849	July-Oct. 1849
1851	24	1	1	166–214	17 Jan. 1851	19 Oct. 1850	15 March 1851	27 March 1851
1851	24	2	3	59–95	3 Aug. 1851	18 May 1851	25 Oct. 1851	Aug.-Oct. 1851
1852	25	2	3	138–181	31 Oct. 1852	25 Oct. 1851	13 Nov. 1852	25 Nov. 1852
1853	26	1	2	249–288	5 Aug. 1853	19 March 1853	29 Oct. 1853	Aug.-Oct. 1853
1854	27	2	4	270–372	13 April 1855	18 Nov. 1854	21 April 1855	3 May 1855
1858	31	1	1	185–250	27 May 1858	17 Oct. 1857	16 Oct. 1858	May-Oct. 1858
1858	31	1	2	379–476	7 Sept 1858	17 Oct. 1857	16 Oct. 1858	28 Oct. 1858
1859	32	1	1	258–277	24 March 1859	15 Oct. 1859	16 Oct. 1859	March-Oct. 1859
1862	35	2	4	321–331	16 May 1863	11 Oct. 1862	17 Oct. 1863	May-Oct. 1863
1863	36	1	2	545–615	11 Sept. 1863	21 Feb. 1863	17 Oct. 1863	Sept.-Oct. 1863
1863	36	2	3	193–227	12 Dec. 1863	17 Oct. 1863	19 Dec. 1863	31 Dec. 1863

* Dates for censor approval and presentation at meetings are in the original Julian calendar. The established publication date has been converted to the Gregorian calendar.

taceae xerocarpicae, in Nova Hollandia a cl. Drumond lectae et plurumque in collectione ejus quinta distributae, determinatae et descriptae'. The publication date of this paper is easily confirmed because of the imprint 'Emis' (issued), in this case 15 June, i.e. 27 June, 1852. The paper was subsequently reset and republished in *Mélanges Biol. Bull. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg* 1(4): 394–428, 20 August, i.e. 1 September, 1852. This paper is of special interest because it described 77 species of Western Australian Myrtaceae and it was not seen by Bentham before he completed Volume 3 of *Flora australiensis* containing the Myrtaceae, published in January 1867 (Bentham 1867, 3: 1–289). The reason for this was probably due to poor postal communications between western Europe and Russia. Russia was involved in a war with Turkey from 1853, effectively cutting off the southern sea route to Russia, and Britain was involved in the Crimean War in 1854–56.

The significance of Turczaninov's contribution

Obviously there are advantages and limitations for taxonomists like Turczaninov who worked on very small samples of foreign floras. There is a greater chance of recording seemingly significant morphological discontinuities in small samples of specimens so that species or generic boundaries may appear substantial. This may partly explain why only a quarter of Turczaninov's 43 genera are currently recognized by Australian taxonomists and many of his 400 species were reduced by Bentham to synonymy (Bentham 1863–1878). Nevertheless, Turczaninov was a competent taxonomist; he had limited access to literature and herbaria and he worked in an area far removed from the centres of taxonomic research. Despite these disadvantages he made a substantial contribution to knowledge of the world flora (Lipschitz 1964). His published descriptions are generally detailed and clear, unlike the descriptions of many of his contemporaries. For example, the description of *Melaleuca cordata* Turcz. (*Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg* 10: 339, 1852) compares favourably with the description for *Melaleuca cordata* Benth. (*Flora australiensis*, 3: 149, 1867). Coincidentally, both descriptions are based on James Drummond 5th collection number 31. *Melaleuca cordata* Turcz. was published in the paper not seen by Bentham.

It is likely that as taxonomic research on the Australian flora proceeds many Turczaninov taxa will be resurrected. To achieve taxonomically sound treatments of the taxa described by Turczaninov it is essential that a study be made of his collection of holotypes in Kiev.

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The Western Australian collecting localities of J. A. L. Preiss

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Abstract

Many of the obscure collecting localities of Preiss have been identified after an analysis of the collecting dates and localities of Preiss published in *Plantae Preissianae*.

Collecting localities of type specimens are usually of special interest to taxonomists. Many of the localities on the labels of specimens of early Australian collectors are often difficult to interpret, especially where geographic names have been changed or may not have been recorded on maps or official gazetteers.

Johann August Ludwig Preiss (1811–1883), collected extensively in south western Australia between 4 December 1838 and 8 January 1842. At this time the Swan River Colony consisted of small settlements at King George Sound (Albany), Busselton, Fremantle, Perth, Guildford and a few inland towns such as York, Toodyay, Pinjarra, Williams and Kojonup (Morison 1979).

Preiss collected approximately 2,800 species of algae, fungi, lichens, bryophytes and flowering plants in the Colony. Most of his specimens were well annotated with locality information and date of collection as well as species number but many of the collecting localities recorded on his specimens and in publications are obscure.

A number of sets of Preiss collections were received by J. G. C. Lehmann in Hamburg who, with nineteen co-authors, published *Plantae Preissianae* (Lehmann 1844–48). In this publication, collections of Preiss, numbered 1 to 2,718, are cited as well as many specimens of James Drummond and some other Australian collectors.

Biographical and other information on Preiss, as well as publication details, are given by McGillivray (1975). Comments on the significance of various sets of collections are given by Nordenstam (1980), Crisp (1983) and Wilson (1983). A summary of the latter three papers and notes on the Preiss collections of the Steetz herbarium is given by Short and Sinkora (1988). Notes on Preiss fungal collections are given by Hilton (1988).

Preiss species numbers

Before Preiss gave his specimens to Lehmann he attempted to arrange the collections so that numbers were assigned on a systematic basis. Specimens were probably renumbered by Preiss in Perth between March 1841 and his departure for Europe on 8 January 1842. Few collections were made by Preiss during this period although much of April to November was spent surveying the Canning River for the Western Australian Lands Department.

Numbers other than those cited in *Plantae Preissianae* appear on specimens now housed in various European herbaria (McGillivray 1975, Lander 1988). These have been regarded as possible field numbers. However this is unlikely as there is no correlation between these and the listed collection dates.

Collecting dates and localities

Provenance names used by Preiss and published in *Plantae Preissianae* are often difficult to trace. As well as many cases where locality names are now no longer in use, there are many orthographic variants. Many specimen provenances mention old County names such as Kent, Howick or Minto. Others are native names which have not been recorded in available literature. A number of the place names are settlers homes or properties; these are often difficult to locate as many of the early colonists had more than one property.

The two volumes of *Plantae Preissianae* have been systematically searched and a record made of each locality and collection date. These data were then transferred to a calendar for the years 1838 to 1842 in an attempt to plot the route of journeys undertaken by Preiss.

There are many inconsistencies of date of collection cited in *Plantae Preissianae*. A number of collections from widely separated localities are cited as having been collected by Preiss on the same date. Thus it is not possible to plot with any accuracy the routes taken. Nevertheless, these data have been used to assist in identifying many of the obscure collecting localities.

Table 1 attempts to identify and give the co-ordinates for Preiss localities listed in *Plantae Preissianae*. Some of these have been located using the Arrowsmith Map of the Colony of Western Australia (Arrowsmith 1839), as well as publications by Bignell (1971), Burton Jackson (1982), Erickson (1969, 1974), , Garden (1979), Glover (1979), Moore (1884), Pelloc (1929), Statham (1979) and Tuckfield (1971). Latitude and longitude have been determined from the *Travellers Atlas of Western Australia* (Anon. 1978). It should be noted that many localities cited in table 1 only refer to the provenance of J. A. L. Preiss collections. Locality names, such as Swan River for example, may have a broader geographic connotation.

Table I
Western Australian collecting localities of J. A. L. Preiss

Adamsriver	= Adams River
Adams River	unknown location in Grantham district.
Albany	35°02′S 117°53′E
Andrews	probably property of W. B. Andrews near Perth
Arthurshead	= Arthurs Head
Arthurs Head	Fremantle, 32° 03′S 115° 44′E
Avondale	homestead near Beverley, 32°07′S 116°52′E
Avon River	between Beverley and Toodyay
Baddagin	unknown location
Bakewel	= Mount Bakewell
Baldhead	= Bald Head
Bald Head	near Albany, 35°07′S 118°01′E
Balgarup	homestead on Albany Hwy south of Kojonup, 33°57′S 117°12′E
Ballanggajalup	unknown location near Cape Riche
Barker	probably S. A. Barker property, near York; also used for Mount Barker
Barrelanjin	= Lake Barrelanjin
Bassandeen	Bassendean, suburban Perth, 31°54′S 115°56′E
Beaufort River	approx., 33°30′S 117°10′E
Bejoording	homestead, 31°23′S 116°32′E
Belgarup	= Balgarup
Beljarup	= Balgarup
Bellevue	suburban Perth, 31°54′S 116°01′E
Bojekar	most probably Boyagerring Creek or Boyagerring Spring, 31°27′S 116°31′E
Bokkenbop	probably the same as Pwakkenbak which is Mount Barker south of the town of Mount Barker, 34°39′S 117°39′E
Brockmann	probably R. J. or W. L. Brockman properties at Northam and York
Brown	property of P. Brown, Swan River
Bulesereek	= Bulls Creek
Bulls	H. Bull property at Picton, Port Leschenault, 33°21′S 115°42′E
Bulls Creek	probably the present day Bull Creek on the Canning River near Perth, 32°02′S 115°53′E
Burgess	D. Burgess property, York
Busseltown	Busselton, 33°39′S 115°20′E
Byster Harbour	= Oyster Harbour
Canning	= Canning River
Canning River	between Kelmscott and Perth
Cape Riche	34°37′S 118°47′E
Carnac Island	32°07′S 115°39′E
Cataract	= Cataracts at head of Swan River
Cataracts at head of Swan River	= Susannah Brook, 31°48′S 116°03′E
Cheyne Beach	= Cheyne Beach
Cheyne's Beach	near Manypeaks, 34°53′S 118°25′E
Colonial Church Grant	East Perth, 31°58′S 115°54′E
Cornac	= Carnac Island
Currie	= Mount Currie
Curru	= Mount Currie
Darling Range, Waterfall at Head	= Cataracts at head of Swan River
Darling Range near waterfall	= Cataracts at head of Swan River
Darling's Range	between Guildford and Halfway House
Davy's	probably J. W. Davey property near York
Drummonds	J. Drummond homestead, 31°30′S 116°25′E
Eboracum	unknown location near Albany
Eight-miles Bridge	8 miles north of Albany, 34°57′S 117°48′E
Eleven Miles Bridge	11 miles north of Albany, 34°53′S 117°47′E
Elizamontagne	= Mount Eliza
Elizamountain	= Mount Eliza
Emuplain	= Emuplains
Emuplains	unknown location in the Darling Range between York and Guildford
Erwin	= Irwin
Freemantle	Fremantle, 32°03′S 115°45′E
Gardenisland	= Garden Island
Garden Island	32°12′S 115°40′E
Gnaden Island	= Garden Island
Gnadenland Island	= Garden Island
Goderich	= Goderich district
Goderich district	between Kojonup and Balgarup
Gordenup	between Manypeak and Cape Riche
Gordon River	34°14′S 117°13′E
Grantham	= Grantham district
Grantham district	north of Williams
Greenmountain	Greenmount, east of Guildford, 31°54′S 116°03′E
Greenmountain (Perth)	= Greenmountain
Greenmountain (York)	= Greenmountain
Greenmountains	= Greenmountain
Gregory	probably property of J. H. Gregory of Pineapple and Perth
Guildford	suburban Perth, 31°54′S 115°59′E
Guildfort	= Guildford
Halfwayhouse	= Halfway House

Table I
Continued

Halfway House	31°54'S 116°20'E
Hardy	probably J. W. Hardey property near Perth or near York
Harris	property of J. Harris, Helena River and Upper Swan
Hassel	J. Hassell property at Kendenup, 34°30'S 117°36'E
Hay	= Hay district
Hay district	between Balgarup and Lake Matilda
Hay River	34°38'S 117°29'E
Heals, York	probably C. Heal homestead, near Northam
Helena River	near Guildford, 31°55'S 116°02'E
Helms	property of T. Helms near Perth
Hesters Point	probably near property of T. Hester, Canning River near Perth
Howick	= Howick district
Howick district	east of York
Interior	between York and Albany, York, Howick, Grantham, Minto, Wicklow, Peel, Goderich and Hay districts
Irwin	F. C. Irwin, Henley Park homestead, Middle Swan
Kalbenup	= Lake Kalbenup
Kandiup	Candyup, hill and homestead east of Albany, 34°56'S 117°59'E
Kaudiap	= Kandiup
Kaudiup	= Kandiup
Ke-eer-mulu	= Keiermulu
Keiermulu	probably an alternative name for Lake Monger or a nearby lake, 31°55'S 115°51'E
Kei-er-mulu	= Keiermulu
Kei-er-mu-lu	= Keiermulu
Kelmscott	suburban Perth, 32°07'S 116°01'E
Kelm-o-scott	= Kelmscott
Kelmsedth	= Kelmscott
Kent	= Kent district
Kent district	between Two Peoples Bay and Cape Riche
King George III Sound	= King George Sound
King Georges Sound	King George Sound, 35°03'S 117°58'E
King's River	Albany, 34°54'S 117°49'E
Klemattini	unknown location, near Davy's, York district. See Vilemattin
Kojonup	33°50'S 117°09'E
Konkoberup	Mt Melville near Cape Riche, 34°36'S 118°44'E
Kurumup River	unknown location
Lake Barrelanjin	unknown location on the Avon River
Lake Daujamlur	unknown location near Perth
Lake Dungumbar	unknown location near Perth
Lake Dunshambus	unknown location near Perth
Lake Kalben	upunknown location, probably near Busselton
Lake Mathilde	Lake Matilda, near Kendenup, 34°26'S 117°36'E
Lenard	= Lennard
Lennard	E. P. B. Lennard homestead, Swan River near Guildford
Lennardt	= Lennard
Leschenault	= Port Leschenault
Lewis Plain	unknown location probably between Guildford and Perth
Limkilen	= Limekiln
Limekiln	near Subiaco, Perth, 31°56'S 115°46'E
Lussen	= Sussex district
McDermot	J. McDermott farm near Northam or M. MacDermott property at Middle Swan
Maddington	suburban Perth, 32°04'S 115°58'E
Mahogany Creek	Darling Range, 31°54'S 116°08'E
Mairu	= Nairn
Manypeak	= Mount Manypeak
Marell	= Morrell
Marrell	= Morrell
Mathildae	= Lake Mathilde
Middle Swan	near Guildford, 31°51'S 116°01'E
Middletonbay	= Middleton Bay
Middleton Bay	Middleton Beach, Albany, 35°01'S 117°55'E
Middletowsbay	= Middleton Bay
Minto	= Minto district
Minto district	south east of Brookton
Mistaken Island	King George Sound, near Albany, 35°03'S 117°56'E
Mitchell	property of W. Mitchell, Upper Swan, 31°46'S 116°01'E
Moeloys Plain	= Molloys Plain
Molloys Plain	probably near Busselton, 33°39'S 115°20'E
Mongerslake	Lake Monger, near Perth, 31°55'S 115°51'E
Moore, G	G. F. Moore property at Millendon, 31°48'S 116°02'E, possibly also near York
Moore, J.	unknown location
Moore, S.	property of S. Moore, Middle Swan
Morrell	property of J. Morrell, Northam
Mount Bakewell	York district, 31°51'S 116°45'E
Mount Barker	34°38'S 117°40'E. See also Bokkenbop
Mount Barrow	34°37'S 117°44'E
Mount Brown	31°53'S 117°48'E

Mount Clarence	near Albany, 35°02′S 117°53′E
Mount Clarence, Perth	= Mount Clarence, Albany
Mount Currie	unknown location, probably on the property once owned by M. Currie, York district
Mount Eliza	Perth, 31°58′S 115°51′E
Mount Elphinstone	near Albany, 35°02′S 117°53′E
Mount Greenmount	= Greenmount
Mount Hardey	31°55′S 116°48′E
Mount Hardy	= Mount Hardey
Mount Kaudiup	= Kandiup
Mount Lehmann	Lemmahns Hill, 31°46′S 116°31′E
Mount Manypeak	Mount Manypeaks, 34°54′S 118°16′E
Mount Mathilda	Mount Matilda, 31°56′S 116°47′E
Mount Melville	near Albany townsite, 35°02′S 117°53′E
Mount Parker	= Mount Barker
Mount T'jalup (Kent)	= Mount Manypeak
Mount Tood-jaykatta	= Tood-yaykatta
Mount Warriup	= Warriup Hills
Mount William	probably Mt Adelaide, Albany, 33°03′S 117°55′E
Mount Wuljenup	= Wuljenup
Murray River	probably near Pinjarra, 32°38′S 115°52′E
Nairn	property of W. Nairn, Canning River near Kelmscott and near Northam
Nairu	= Nairn
Nash	property of R. W. Nash near Perth
Nelson	= Nelson district
Nelson district	near Capel
Oyster Harbour	near Albany , 34°58′S 117°58′E
Parker	S. Parker or S. Parker snr property, near York
Peel	= Peel district
Peel district	near Katanning
Penguin Island	near Safety Bay, 32°18′S 115°41′E
Peninsular	suburban Perth, 31°57′S 115°54′E
Perth	usually refers to the near city area, 31°57′S 115°52′E
Philips	= Phillips
Phillips	property of S. P. Phillips, Culham, 31°25′S 116°27′E
Philops	= Phillips
Pineapple	Pineapple Inn, near Perth, 31°56′S 115°53′E
Pitseharding	unknown location in Victoria district
Pitseharding Spring	unknown location in Victoria district
Plantagenet	= Plantagenet district
Plantagenet district	between Lake Matilda, Albany and Two Peoples Bay
Pointpossession	= Point Possession
Point Possession	near Albany, 35°03′S 117°55′E
Pointwater	Point Walter between Canning River and Fremantle, 32°01′S 115°48′E
Point William	King George Sound, 35°03′S 117°55′E
Port Leschenault	Australind, 33°16′S 115°44′E
Preiss Well	unknown location probably near St Ronans Well
Preissvell	= Preiss Well
Preston Creek, Perth	probably near Guildford
Preston River (Perth)	= Preston River
Preston River	near Port Leschenault, 33°33′S 116°04′E
Princess Royal Harbour	near Albany , 35°04′S 117°53′E
Pwakkenbak	= Bokkenbop
Quangen	near Wongamine, east of Toodyay, 31°29′S 116°37′E
Rich. Spencer	= Spencer
Rocky Bay	North Fremantle, 32°02′S 115°44′E
Ronau's Well	= St Ronans Well
Rotenest	= Rottnest
Rottennest	= Rottnest
Rottnest	Rottnest Island, 32°00′S 115°31′E
St Georges Terrace	Perth, 31°57′S 115°52′E
St Ronan's Well	between Perth and Beverley, 32°56′S 116°01′E
St Rozins Well	= St Ronan's Well
Saltriver	Jennacubbine River, 31°03′S 116°42′E
Serpentine River	32°32′S 115°46′E
Serpentum River	= Serpentine River
Seven miles bridge	seven miles north of Albany, 34°56′S 117°48′E
Skelmscott	= Kelmscott
Southern River	suburban Perth near Canning River, 32°05′S 115°56′E
Spence	= Spencer
Spencer	Strawberry Hill farm, Albany, 35°02′S 117°53′E
Spenier	= Spencer
Spites	brookunknown location on the Canning River
Springhill	Agett property near Northam
Stirling Terrace	Albany townsite, 35°02′S 117°53′E
Strawberry Hill	property of R. Spencer, Albany, 35°02′S 117°53′E
Sussex	= Sussex district
Sussex district	between Capel and Toby's Inlet

Table I
Continued

Swan River	Swan river between Perth and Millendon, Guildford district
Swan River, cataracts at head	= Cataracts at head of Swan River
Swan River, head	Millendon, near Guildford, 31°48′S 116°03′E
Swan River, mouth	= Freemantle
Swan waterfall	= Cataracts at head of Swan River
T'jallop	= Mount Manypeak
Tjelberup	= Mount Manypeak
Tjilberup	= Mount Manypeak
T'jilberup (Kent)	= Mount Manypeak
T'jilberup (Plantagenet)	= Mount Manypeak
Toby's Inlet	Toby Inlet, near Busselton, 33°39′S 115°11′E
Toby's Insel	= Toby's Inlet
Toby's Julet	= Toby's Inlet
Toodgay	= Toodyay
Toodgayvalley	= Toodyay
Toodyay	Victoria district, 31°33′S 116°28′E
Tood-yaykatta	near Toodyay, 31°30′S 116°25′E
Twopeopledbay	= Two Peoples Bay
Two Peoples Bay	near Albany, 34°57′S 118°11′E
Vasse	Busselton, 33°39′S 115°20′E
Vasse inlet	= Vasse
Vilemattin	unknown location, near Davy's, York district
Viveach	S. W. Viveash property, near Beverley
Wariup Hills	= Warriup Hills
Warreup-Hills	= Warriup Hills
Warreup Hills	= Warriup Hills
Warriuphills	= Warriup Hills
Warriup Hills	Geekabee Hill, near Cranbrook, 34°19′S 117°24′E
Wellington district	between Waroona and Capel
Wellington River	unknown location near Bunbury
Whitfield, York	property of F. J. Whitfield, near Toodyay
Wicklow	= Wicklow district
Wicklow district	between Williams and Kojonup
Williams	33°02′S 116°53′E
Williamsburg	= Williams
Williamspoint	= Point William
Wittenoom	probably property of C. Wittenoom, York
Woodbridge	near Guildford, 31°54′S 115°53′E
Woodmans Point	Woodman Point, 32°08′S 115°44′E
Wuljenup	Willyung Hill, near Albany, 34°57′S 117°51′E
York	31°53′S 116°46′E
York district	between Toodyay and north of Northam

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Cunningham's collecting localities while botanist on Lieutenant Phillip Parker King's survey of coastal Australia, December 1817 to April 1822.

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Allan Cunningham was one of Australia's foremost botanist-explorers. He was born in England in 1791 and was originally intended for the law office. However, he found this unsuitable (McMinn 1970) and was subsequently appointed by William T. Aiton to the Royal Botanic Gardens, Kew to assist in the preparation of the 2nd edition of *Hortus Kewensis* (Aiton 1810–1813). In 1814, under the direction of Sir Joseph Banks, Cunningham was appointed as a botanical collector. After a successful excursion to Brazil he was directed to New South Wales and arrived in Sydney on 20 December 1816 (McMinn op. cit.). Beside his activities in coastal areas of Australia, which are the subject of this paper, Cunningham explored and collected extensively in inland areas of eastern Australia.

Between December 1817 and April 1822 Cunningham accompanied Lieutenant Phillip Parker King on five voyages undertaken to survey various parts of the Australian coastline. As ship's botanist Cunningham collected assiduously from numerous localities and many of his collections subsequently became type material.

The voyages undertaken by Cunningham in the ships *Mermaid* and *Bathurst* were:

Voyage 1 (*Mermaid*), 22 Dec. 1817–29 July 1818 (Fig. 1);

Voyage 2 (*Mermaid*), 8 May 1819–12 Jan. 1820 (Fig. 2);

Voyage 3 (*Mermaid*), 14 June 1820–9 Dec. 1820 (Fig. 3);

Voyage 4 (*Bathurst*), 26 May 1821–25 April 1822 (Fig. 4); and

Tasmania (*Mermaid*) was visited between Voyages 1 and 2, 25 Dec. 1818–14 Feb. 1819.

Cunningham often listed his collecting localities within broad geographic zones. These zones are given in Cunningham's manuscript, often on his specimen labels, and are sometimes cited in publications, e.g. Bentham (1863–1878). The zones that he recognized were:

East coast — encompassing collecting localities of Twofold Bay, N.S.W., north to Cairncross Island, Qld.

North coast — encompassing collecting localities of Booby Island, Qld, west to Bathurst Island, N.T.

North-west coast — encompassing collecting localities of Port Keats, W.A., south to Bay of Rest, W.A.

West coast — encompassing collecting localities of Dirk Hartog Island, W.A., south to Rottnest Island, W.A.

South-west coast — King George Sound, W.A.

South coast — Middle Island, Recherche Archipelago, W.A.

The purpose of this paper is to identify each of Cunningham's collecting localities and to enable them to be readily retrieved by locality or date of collection. A detailed account of each locality visited will be published elsewhere by the first author.

Methods

The information presented in this work was derived primarily from copies of Cunningham's unpublished journals, King (1827), and copies of King's unpublished charts. These charts were supplied by the Hydrographic Office, London, and by Professor R. Appleyard, Dept of Economics, University of Western Australia. Supplementary data were derived from Heward (1842), Lee (1925) and McMinn (1970).

Appendix I is an alphabetic listing of Cunningham's collecting localities.

Appendix II contains much the same data arranged chronologically. The routes undertaken during each of the four mainland voyages are shown in Figs 1–4. The following notes are provided to explain the information contained in the Appendices.

Collecting localities

Cunningham was usually very explicit as to the localities he visited and collected from. In a few instances, however, we were unsure as to whether a particular location was visited, e.g. Hummock Hill Island. In these cases we have included an appropriate footnote in Appendix I. When he stated that no plants were collected, the site is not included in the present work. In the few cases where he failed to indicate whether or not collections were made we include the locality.

In many instances Cunningham collected from more than one locality within an extended geographic area, e.g. Dampier Archipelago, King George Sound, North and South Goulburn Islands. For convenience, we have in some cases arbitrarily defined extended areas, e.g. Brunswick Bay (which includes St George Basin, Prince Regent River, Greville Island, Hanover Bay and Port George IV). The names given in upper case in Appendices I and II (and shown in Figs 1–4)

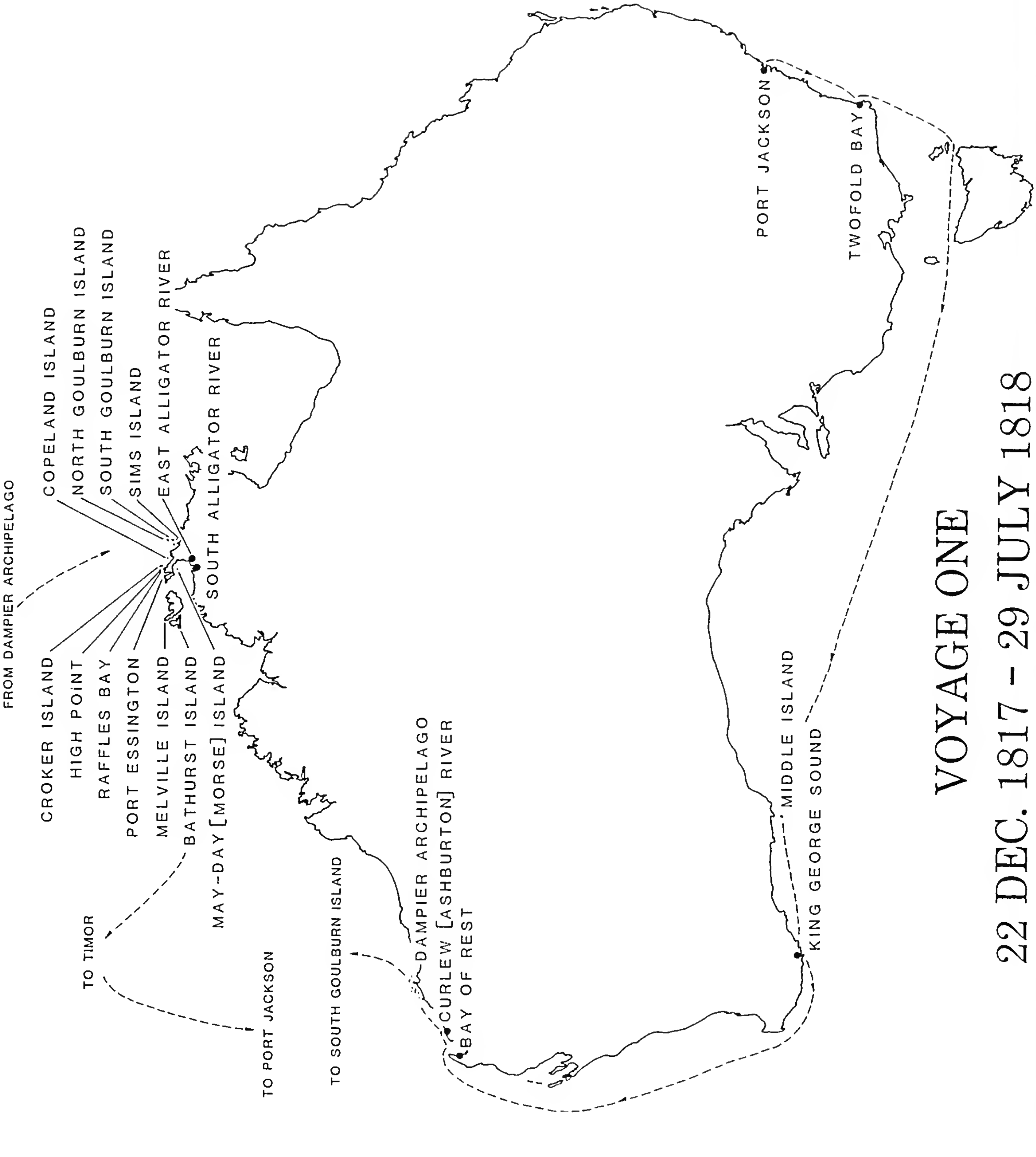

Fig. 1. Route map of Voyage 1.

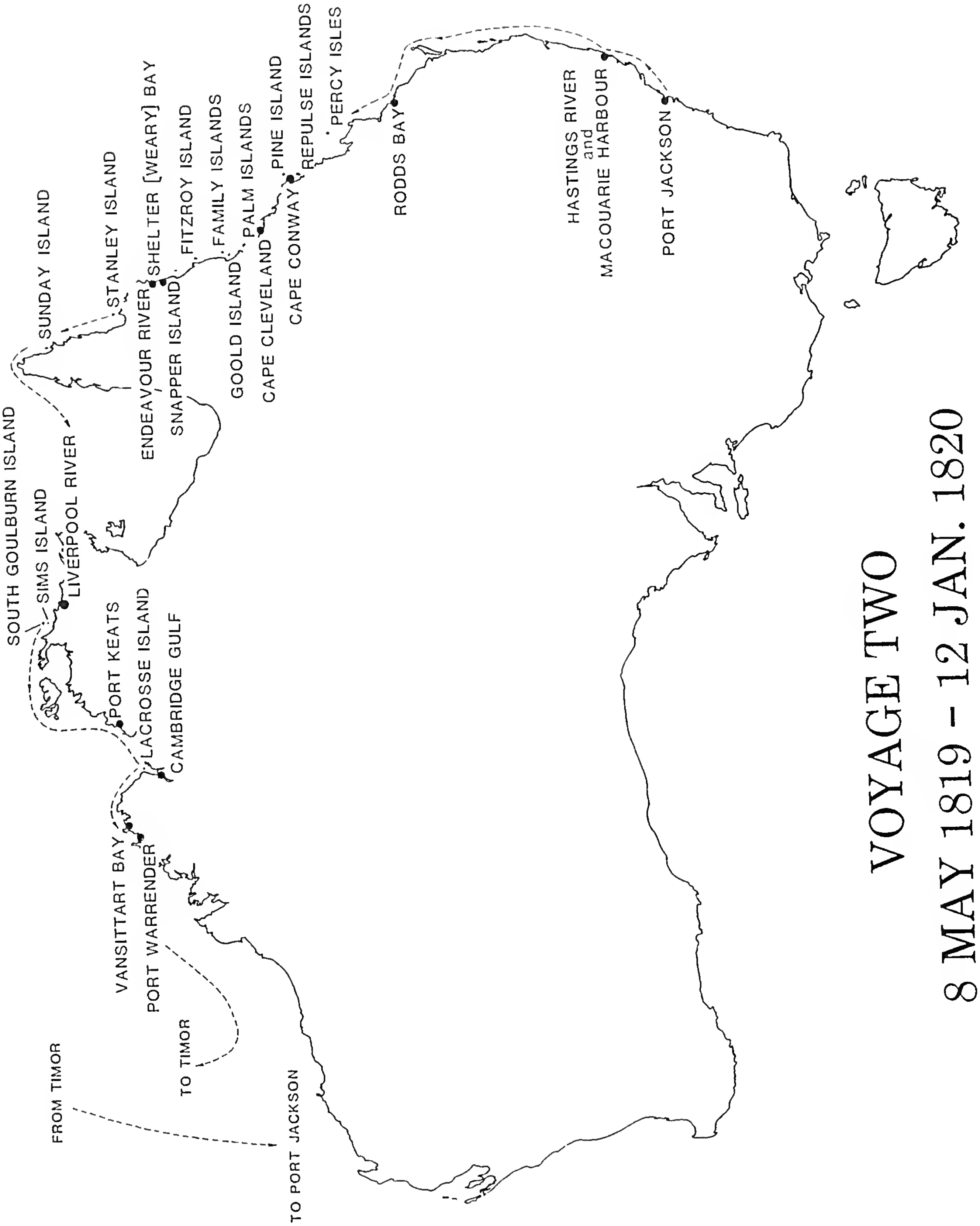

Fig. 2. Route map of Voyage 2.

Fig. 3. Route map of Voyage 3.

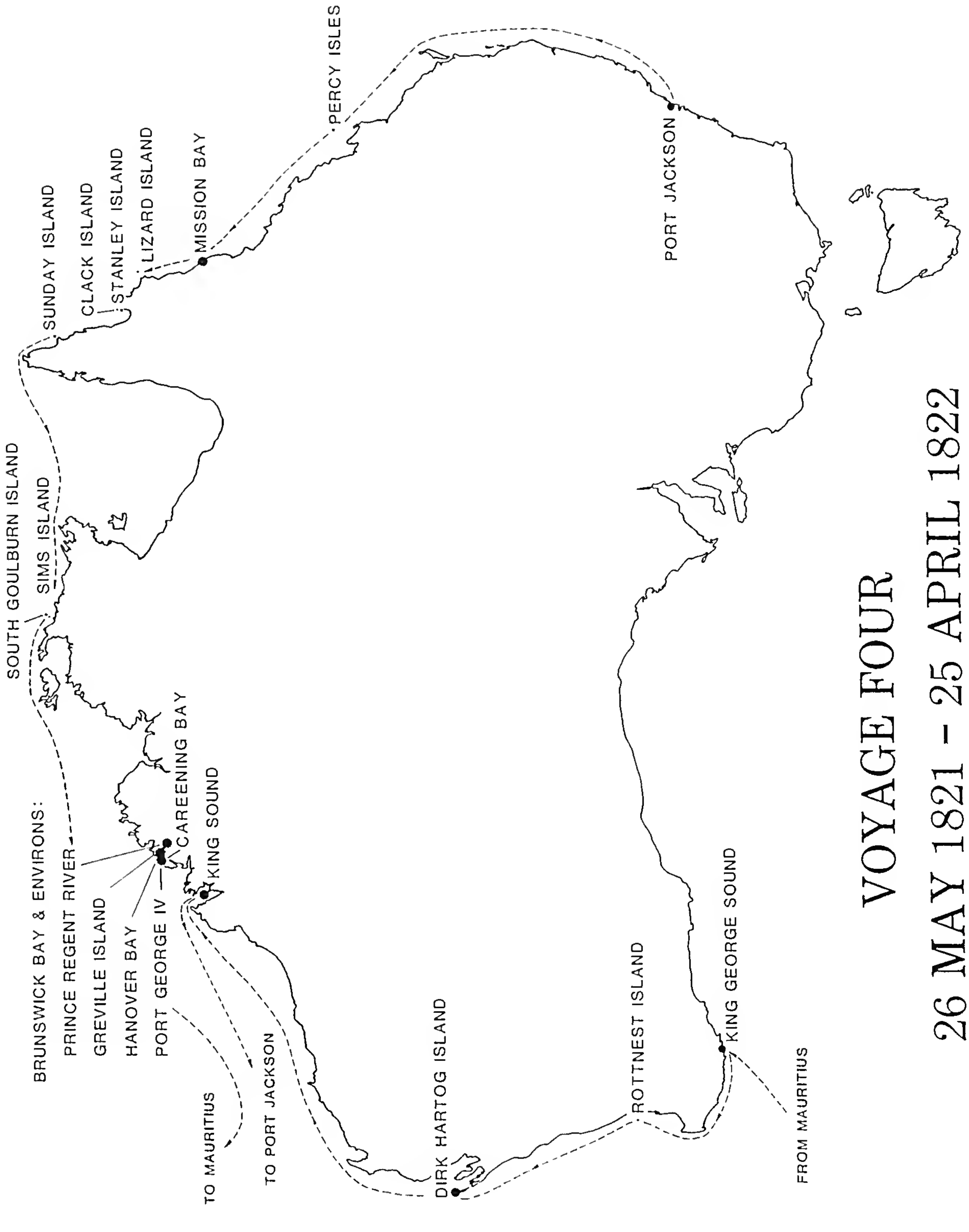

Fig. 4. Route map of Voyage 4.

represent both extended geographical areas and specific collecting localities.

Place names
Where possible, place names in Appendices I and II are listed according to Cunningham's nomenclature. In instances where his names differ from those in current use the localities are listed under both names, with the current name given in square brackets. Sometimes Cunningham did not name the area visited; in these cases we provide the current names but do not indicate that they were secondarily derived, e.g. Mount Adelaide in King George Sound.

Latitude and longitude
These parameters have been determined to the nearest minute. They usually represent, as far as can be determined, the actual collecting site. In some cases, however, it was not possible to pin-point this: for example, when Cunningham travelled up the South Alligator River and did not indicate exactly from where the collections were made. In such cases our latitude and longitudes represent an arbitrary point (usually the midpoint) within the collecting range.

Collector
In a few cases collections were made on Cunningham's behalf by other expedition members. For example, between 25 July and 29 July 1821 Cunningham was confined to the ship because of illness. During this period some plants were collected by Cunningham's servant and by King from the Prince Regent River. In the detailed description of Cunningham's sites to be published elswhere, such events are noted.

Dates of collection
The dates given in Appendices I and II are usually actual collecting dates. They do not include the days that the *Mermaid* or *Bathurst* arrived at, or departed from, a particular locality, unless of course, collections were made on these days. It should be noted, however, that the dates given here cannot always be taken as indications that plants were collected on those days. In a few cases Cunningham failed to indicate whether or not plants were gathered on a particular day (see above). Also, Cunningham occasionally did not collect on a particular day they were at anchor (e.g. he may have been ill, curating specimens on board, or having a lay-day, etc.). Although such occurrences will appear in the detailed account in preparation, these dates have not been excised from those given in Appendices I and II.

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Appendix I

Alphabetic listing of Cunningham collecting localities

Column 1: collecting locality (see text for explanation). **Column 2:** place-name appearing in Figs 1–4. **Column 3:** State or Territory of Australia. **Columns 4 & 5:** latitude and longitude (see text for explanation). **Column 6:** voyage number (TAS — Visit to Tasmania undertaken between voyages 1 and 2). **Column 7:** date of collection (see text for explanation).

Collecting locality	Map locality	State	Lat.	Long.	Voyage	Collecting date
Adolphus Island	CAMBRIDGE GULF	W.A.	15°09'S	128°08'E	2	19–20, 28 Sept. 1819
Anyiminali Point[1]	SOUTH GOULBURN ISLAND	N.T.	11°38'S	133°21'E	3	25 Aug. 1820
Ashburton River (see Curlew River)						
Augereau Island	YORK SOUND	W.A.	14°45'S	125°08'E	3	9 Sept. 1820
Augustus Island (see Point Adieu)						
Bald Head	KING GEORGE SOUND	W.A.	35°06'S	118°01'E	4	4 Jan. 1822
Bat Island[2]	CAREENING BAY	W.A.	15°06'S	124°55'E	3	2 Oct. 1820
Bathurst Island	BATHURST ISLAND	N.T.	11°39'S	130°13'E	1	25–26 May 1818
Bay of Rest, Exmouth Gulf	BAY OF REST, EXMOUTH GULF	W.A.	22°18'S	114°08'E	1	15–17 Feb. 1818
Bayonet Head (see Bayonet Point)						
Bayonet Point [=Bayonet Head]	KING GEORGE SOUND	W.A.	34°58'S	117°57'E	1	24, 27 Jan. 1818
Berkeley Bay	PORT ESSINGTON	N.T.	11°13'S	132°11'E	1	20 Apr. 1818
Betsey Island [=Elizabeth Island]	MACQUARIE HARBOUR	TAS.	42°16'S	145°17'E	TAS.	20 Jan. 1819
Bird Islets [=Shag Islands]	MACQUARIE HARBOUR	TAS.	42°16'S	145°17'E	TAS.	20 Jan. 1819
Bloomfield River (see Bloomfields Rivulet)						
Bloomfields Rivulet [=Bloomfield River]	SHELTER BAY	QLD	15°58'S	145°19'E	2	26 June 1819
Bonnet Island (see Rocky Island)						
Booby Island	BOOBY ISLAND	QLD	10°36'S	141°54'E	3	16 Aug. 1820
Bottle Rock	SOUTH GOULBURN ISLAND	N.T.	11°38'S	133°21'E	1	29 Mar., 1 Apr. 1818

Collecting locality	Map locality	State	Lat.	Long.	Voyage	Collecting date
Brunswick Bay and environs (see St George Basin, Prince Regent River, Greville Island, Hanover Bay, Port George IV)						
Bulburra Beach[3]	MISSION BAY	QLD	16°54'S	145°54'E	4	18 June 1821
Burrup Peninsula	DAMPIER ARCHIPELAGO	W.A.	20°38'S	116°45'E	1	28 Feb. 1818
Caiman Creek	PORT ESSINGTON	N.T.	11°14'S	132°12'E	1	20 Apr. 1818
Cairncross Island	CAIRNCROSS ISLAND	QLD	11°15'S	142°55'E	3	14 Aug. 1820
Cambridge Gulf (see localities under 19–28 Sept. 1819 in Appendix 11)						
Cape Cleveland	CAPE CLEVELAND	QLD	19°11'S	147°01'E	2	14–16 June 1819
Cape Conway	CAPE CONWAY	QLD	20°32'S	148°56'E	2	9 June 1819
Cape Flinders	STANLEY ISLAND	QLD	14°08'S	144°14'E	2	14–15 July 1819
					3	9 Aug. 1820
					4	22 June 1821
Cape Inscription	DIRK HARTOG ISLAND	W.A.	25°29'S	112°58'E	4	21 (?also 22, 23) Jan. 1822
Cape Levillain	DIRK HARTOG ISLAND	W.A.	25°30'S	113°01'E	4	24–25 Jan. 1822
Cape Pond[4]						
Caper Point[5]	CAREENING BAY	W.A.	15°07'S	124°57'E	3	2 Oct. 1820
Capstan Island	CAPSTAN ISLAND	W.A.	14°35'S	125°16'E	3	8 Sept. 1820
Careening Bay	CAREENING BAY	W.A.	15°06'S	125°00'E	3	21 Sept.–6 Oct. 1820
					4	23–24 July 1821
Cartha Island [=Garden Island]	GOOLD ISLAND	QLD	18°11'S	146°09'E	2	20 June 1819
Castle Peaks (see Mount Dreary)						
Channel Bay	MACQUARIE HARBOUR	TAS.	42°14'S	145°13'E	TAS.	18 Jan. 1819
Cherry Tree Bay[6]	ENDEAVOUR RIVER	QLD	15°28'S	124°16'E	3	4 Aug. 1820
Clack Island	CLACK ISLAND	QLD	14°04'S	144°15'E	4	23 June 1821
Cleveland Bay	CAPE CLEVELAND	QLD	19°13'S	146°55'E	2	14–16 June 1819
Cliff Island (see Bat Island)						
Cockatoo Hill	PERCY ISLES	QLD	21°38'S	150°15'E	4	10 June 1821
Collins Hill	SHELTER BAY	QLD	15°56'S	145°22'E	2	26 June 1819
Cone Point	NORTH GOULBURN ISLAND	N.T.	11°30'S	133°23'E	1	7 Apr. 1818
Copeland Island	COPELAND ISLAND	N.T.	11°29'S	132°43'E	1	12 Apr. 1818
Courtenay Head, Malus Island	DAMPIER ARCHIPELAGO	W.A.	20°31'S	116°41'E	1	1 Mar. 1818
Croker Island	CROKER ISLAND	N.T.	11°05'S	132°28'E	1	14 Apr. 1818
Crystal Head[7]	PORT WARRENDER	W.A.	14°29'S	125°51'E	2	10 Oct. 1819
Cunningham Point (see Point Cunningham)						
Curlew River [=Ashburton River]	CURLEW RIVER	W.A.	21°42'S	114°56'E	1	20 Feb. 1818
Cygnet Bay[8]						
Dampier Archipelago	DAMPIER ARCHIPELAGO	W.A.	20°33'S	116°32'E	1	25 Feb.–1 Mar. 1818
Derwent River (see Hobart Town)						
Dirk Hartog Island	DIRK HARTOG ISLAND	W.A.	25°30'S	112°59'E	4	21–25 Jan. 1822
East Alligator River	EAST ALLIGATOR RIVER	N.T.	12°11'S	132°46'E	1	6 May 1818
East Intercourse Island	DAMPIER ARCHIPELAGO	W.A.	20°39'S	116°41'E	1	27 Mar. 1818
Elizabeth Island (see Betsey Island)						
Emu Point	KING GEORGE SOUND	W.A.	35°00'S	117°57'E	1	24, 28 Jan. 1818
					4	26 Dec. 1821
Encounter Cove	VANSITTART BAY	W.A.	14°07'S	126°11'E	2	6 Oct. 1819
Endeavour River	ENDEAVOUR RIVER	QLD	15°27'S	145°13'E	2	28 June–10 July 1819
					3	27 July–4 Aug. 1820
Endeavour River South Branch	ENDEAVOUR RIVER	QLD	15°27'S	145°13'E	2	9 July 1819
Enderby Island	DAMPIER ARCHIPELAGO	W.A.	20°37'S	116°28'E	1	25 Feb. 1818
Entrance Island	MACQUARIE HARBOUR	TAS.	42°13'S	145°13'E	TAS.	15 Jan. 1819
Entrance Island	PORT GEORGE IV	W.A.	15°17'S	124°37'E	4	11 Aug. 1821
Family Islands	FAMILY ISLANDS	QLD	18°02'S	146°12'E	2	21 June 1819
Finch Bay	ENDEAVOUR RIVER	QLD	15°28'S	145°16'E	2	2 July 1819
Fitzroy Island	FITZROY ISLAND	QLD	16°56'S	146°00'E	2	22–23 June 1819
French River [=Kalgan River]	KING GEORGE SOUND	W.A.	34°56'S	117°58'E	1	25 Jan. 1818
Frenchman Bay	KING GEORGE SOUND	W.A.	35°05'S	117°57'E	1	20 Jan. 1818
					4	3–5 Jan. 1822
Gap Island (see Greville Island)						
Garden Island [=Green Island]	KING GEORGE SOUND	W.A.	34°59'S	117°57'E	1	21, 27 Jan. 1818
Garden Island (see Cartha Island)						
Goodenough Bay[9]	KING SOUND	W.A.	16°49'S	123°09'E	4	9 Feb. 1822
Goold Island	GOOLD ISLAND	QLD	18°10'S	146°10'E	2	20 June 1819
Goose Island Bay	MIDDLE ISLAND, RECHERCHE ARCHIPELAGO	W.A.	34°05'S	123°12'E	1	16 Jan. 1818
Goulburn Islands (see North or South Goulburn Islands)						
Government House Lake	ROTTNEST ISLAND	W.A.	32°00'S	115°31'E	4	14 Jan. 1822
Grassy Hill	ENDEAVOUR RIVER	QLD	15°28'S	145°15'E	2	6 July 1819
					3	4 Aug. 1820[10]
Green Island (see Garden Island)						
Greville Island[11]	GREVILLE ISLAND	W.A.	15°19'S	124°51'E	4	30 July, 1–3 Aug. 1821
Haggerstone Island	HAGGERSTONE ISLAND	QLD	12°03'S	143°18'E	3	13 Aug. 1820
Halfway Bay[12]	GREVILLE ISLAND	W.A.	15°19'S	124°51'E	4	1–3 Aug. 1821
Hanover Bay	HANOVER BAY	W.A.	15°19'S	124°46'E	4	6 Aug. 1821
Hastings River	HASTINGS RIVER and PORT MACQUARIE	N.S.W.	31°24'S	152°50'E	2	14–16 May 1819
Havannah Island (see Island No.2)						
Heron Pond (see Outer Bay)						
High Point	HIGH POINT	N.T.	11°13'S	132°26'E	1	15 Apr. 1818
Hobart (see Hobart Town)						

Collecting locality	Map locality	State	Lat.	Long.	Voyage	Collecting date
Hobart Town [=Hobart][13]	HOBART TOWN	TAS.	42°52'S	147°20'E	TAS.	5–9 Jan., 1–5 Feb. 1819
Hummock Hill Island[14]	RODDS BAY	QLD	24°00'S	151°28'E	2	30 May 1819
Hummock Island (see The Lump)						
Hunter River	PRINCE FREDERICK HARBOUR	W.A.	15°02'S	125°26'E	3	13, 16–18 Sept. 1820
Intercourse Island	DAMPIER ARCHIPELAGO	W.A.	20°39'S	116°38'E	1	27 Feb. 1818
Island No.2 [=Havannah Island]	PALM ISLANDS	QLD	18°50'S	146°32'E	2	18 June 1819
Jar Island	VANSITTART BAY	W.A.	14°09'S	126°14'E	2	6 Oct. 1819
Kalgan River (see French River)						
Kanunga Point	BATHURST ISLAND	N.T.	11°39'S	130°11'E	1	25 May 1818
Katers Island[15]	MONTAGUE SOUND	W.A.	14°30'S	125°33'E	3	6 Sept. 1820
King Bay	DAMPIER ARCHIPELAGO	W.A.	20°38'S	116°45'E	1	28 Feb. 1818
King Cascade	PRINCE REGENT RIVER	W.A.	15°38'S	125°18'E	4	26 July 1821
King George IV Sound (see King George Sound)						
King George Sound	KING GEORGE SOUND	W.A.	35°01'S	117°53'E	1	20–31 Jan. 1818
					4	24 Dec. 1821–5 Jan. 1822
King River	PORT ESSINGTON	N.T.	11°21'S	132°07'E	1	23 Apr. 1818
King Sound	KING SOUND	W.A.	16°50'S	123°30'E	4	9–12 Feb. 1822
Knocker Bay	PORT ESSINGTON	N.T.	11°18'S	132°08'E	1	23 Apr. 1818
Lacrosse Island	LACROSSE ISLAND	W.A.	14°44'S	128°18'E	2	17 Sept. 1819
Lake Seppings	KING GEORGE SOUND	W.A.	35°01'S	117°55'E	1	31 Jan. 1818
Lammas Island (see Greville Island)						
Limestone Head	KING GEORGE SOUND	W.A.	35°05'S	118°00'E	4	3 Jan. 1822
Liverpool River	LIVERPOOL RIVER	N.T.	12°15'S	134°07'E	2	5–6 Aug. 1819
Lizard Island	LIZARD ISLAND	QLD	14°40'S	145°28'E	3	6 Aug. 1820
					4	20 June 1821
Long Island	VANSITTART BAY	W.A.	13°57'S	126°19'E	2	3 Oct. 1819
Luxmore Head	MELVILLE ISLAND	N.T.	11°21'S	130°23'E	1	17 May 1818
Macquarie Harbour	MACQUARIE HARBOUR	TAS.	42°15'S	145°15'E	TAS.	13–25 Jan. 1819
Malus Island	DAMPIER ARCHIPELAGO	W.A.	20°31'S	116°41'E	1	1 Mar. 1818
Mangrove Bay	RODDS BAY	QLD	24°03'S	151°35'E	2	30 May 1819
Mangrove Point	PORT ESSINGTON	N.T.	11°24'S	132°11'E	1	21 Apr. 1818
Margaret Bay	SUNDAY ISLAND	QLD	11°56'S	143°12'E	2	22 July 1819
					4	27–28 June 1821
Marney Bay, Malus Island	DAMPIER ARCHIPELAGO	W.A.	20°31'S	116°41'E	1	1 Mar. 1818
May-Day Island [=Morse Island]	MAY-DAY ISLAND	N.T.	11°35'S	132°19'E	1	1 May 1818
Melville Island	MELVILLE ISLAND	N.T.	11°21'S	130°23'E	1	17 May 1818
Middle Head	PORT ESSINGTON	N.T.	11°22'S	132°11'E	1	20 Apr. 1818
Middle Island, Recherche Archipelago	MIDDLE ISLAND, RECHERCHE ARCHIPELAGO	W.A.	34°06'S	123°11'E	1	16 Jan. 1818
Middle Island (see Percy Isle No.2)						
Middleton Beach	KING GEORGE SOUND	W.A.	35°00'S	117°56'E	1	22, 31 Jan. 1818
Mission Bay	MISSION BAY	QLD	16°53'S	145°53'E	4	17–18 June 1821
Mistaken Island	DAMPIER ARCHIPELAGO	W.A.	20°39'S	116°40'E	1	27 Mar. 1818
Mistaken Island	KING GEORGE SOUND	W.A.	35°04'S	117°56'E	4	5 Jan. 1822
Montague Sound	MONTAGUE SOUND	W.A.	14°26'S	125°33'E	3	6–8 Sept. 1820
Morse Island (see May-Day Island)						
Mount Adelaide	KING GEORGE SOUND	W.A.	35°02'S	117°55'E	1	22, 31 Jan. 1818
Mount Brookes[16]	PRINCE FREDERICK HARBOUR	W.A.	15°10'S	125°26'E	3	13 Sept. 1820
Mount Cook	ENDEAVOUR RIVER	QLD	15°30'S	145°16'E	2	2 July 1819
					3	2 Aug. 1820
Mount Dreary [=Castle Peaks]	STANLEY ISLAND	QLD	14°09'S	144°15'E	2	14 July 1819
					3	9 Aug. 1820
Mount Flinders[17]	PORT BOWEN	QLD	22°33'S	150°46'E	3	22 July 1820
Mount Knight	CAREENING BAY	W.A.	15°09'S	125°02'E	3	25 Sept. 1820
Mount Martin (area)	KING GEORGE SOUND	W.A.	35°00'S	117°58'E	1	22, 24, 26 Jan. 1818
					4	25–26, 28–29 Dec. 1821
Mount Saunders	ENDEAVOUR RIVER	QLD	15°25'S	145°14'E	2	5 July 1819
					3	28 July 1820
Mount Table [=Mount Wellington]	HOBART TOWN	TAS.	42°54'S	147°14'E	TAS.	7–8 Jan. 1819
Mount Wellington (see Mount Table)						
Mountnorris Bay	COPELAND ISLAND	N.T.	11°29'S	132°43'E	1	12 Apr. 1818
Mullet Bay	NORTH GOULBURN ISLAND	N.T.	11°31'S	133°23'E	1	5–7 Apr. 1818
Munster Water[18]	GREVILLE ISLAND	W.A.	15°18'S	124°50'E	4	4 Aug. 1821
Myola Bluff (see Vine Head)						
Nicholls Point, Adolphus Island	CAMBRIDGE GULF	W.A.	15°03'S	128°08'E	2	20, 28 Sept. 1819
North Goulburn Island	NORTH GOULBURN ISLAND	N.T.	11°31'S	133°23'E	1	5–7 Apr. 1818
Outer Bay [=Pilot Bay]	MACQUARIE HARBOUR	TAS.	42°12'S	145°12'E	TAS.	13–14[19], 25 Jan. 1819
Oyster Harbour	KING GEORGE SOUND	W.A.	34°59'S	117°57'E	1	21–31 Jan. 1818
					4	24–31 Dec. 1821
Oyster Point	PORT ESSINGTON	N.T.	11°18'S	132°08'E	1	23 Apr. 1818
Palm Bay	CROKER ISLAND	N.T.	11°05'S	132°28'E	1	14 Apr. 1818
Palm Islands	PALM ISLANDS	QLD	18°50'S	146°32'E	2	18 June 1819
Pelican Island	PELICAN ISLAND	QLD	13°55'S	143°50'E	3	10 Aug. 1820
Pelican Point	HASTINGS RIVER and PORT MACQUARIE	N.S.W.	31°26'S	152°55'E	2	18 May 1819
Pentecost River	CAMBRIDGE GULF	W.A.	15°38'S	127°52'E	2	25 Sept. 1819

Collecting locality	Map locality	State	Lat.	Long.	Voyage	Collecting date
Percy Isle No. 1 [=South Island]	PERCY ISLES	QLD	21°45'S	150°20'E	2	3–4 June 1819
Percy Isle No. 2 [=Middle Island]	PERCY ISLES	QLD	21°39'S	150°16'E	4	10–11 June 1821
Percy Isles (see above)						
Pilot Bay (see Outer Bay)						
Pine Cove	MACQUARIE HARBOUR	TAS.	42°12'S	145°21'E	TAS.	21–23 Jan. 1819
Pine Head	PINE ISLAND	QLD	20°23'S	148°54'E	2	10 June 1819
Pine Island	PINE ISLAND	QLD	20°23'S	148°54'E	2	10 June 1819
Point Adieu, Augustus Island	PORT GEORGE IV	W.A.	15°15'S	124°34'E	4	13 Aug. 1821
Point Cunningham [=Cunningham Point]	KING SOUND	W.A.	16°41'S	123°08'E	4	9, 12 Feb. 1822
Point Saunders	ENDEAVOUR RIVER	QLD	15°28'S	145°14'E	2	5 July 1819
					3	28 July 1820
Port Bowen[20] [=Port Clinton]	PORT BOWEN	QLD	22°32'S	150°45'E	3	21–22 July 1820
Port Clinton (see Port Bowen)						
Port Cockburn (see St Asaph Bay)						
Port Essington	PORT ESSINGTON	N.T.	11°15'S	132°08'E	1	20–24 Apr. 1818
Port George IV	PORT GEORGE IV	W.A.	15°20'S	124°38'E	4	11–13 Aug. 1821
Port Hurd	BATHURST ISLAND	N.T.	11°39'S	130°13'E	1	25–26 May 1818
Port Keats	PORT KEATS	N.T.	14°08'S	129°33'E	2	6–7 Sept. 1819
Port Macquarie	HASTINGS RIVER and PORT MACQUARIE	N.S.W.	31°27'S	152°55'E	2	11–13, 18–20 May 1819
Port Nelson[21]						
Port Warrender	PORT WARRENDER	W.A.	14°34'S	125°52'E	2	10–12 Oct. 1819
Prince Frederick Harbour	PRINCE FREDERICK HARBOUR	W.A.	15°07'S	125°20'E	3	11–18 Sept. 1820
Prince Regent River	PRINCE REGENT RIVER	W.A.	15°30'S	125°08'E	3	12 Oct. 1820
					4	26–28 July 1821
Princess Royal Harbour	KING GEORGE SOUND	W.A.	35°02'S	117°55'E	1	22, 31 Jan. 1818
Raffles Bay	RAFFLES BAY	N.T.	11°19'S	132°24'E	1	17–18 Apr. 1818
Record Point	PORT ESSINGTON	N.T.	11°19'S	132°10'E	1	22 Apr. 1818
Regent(s) River (see Prince Regent River)						
Repulse Bay, islands of (see Repulse Islands)						
Repulse Islands	REPULSE ISLANDS	QLD	20°37'S	148°52'E	2	8 June 1819
River Point [=Yellow Bluff]	MACQUARIE HARBOUR	TAS.	42°13'S	145°18'E	TAS.	21 Jan. 1819
Rockingham Bay	GOOLD ISLAND	QLD	18°09'S	146°10'E	2	20 June 1819
Rocky Head, Enderby Island	DAMPIER ARCHIPELAGO	W.A.	20°37'S	116°28'E	1	25 Feb. 1818
Rocky Island	MISSION BAY	QLD	16°53'S	145°54'E	4	17 June 1821
Rocky Island [=Bonnet Island]	MACQUARIE HARBOUR	TAS.	42°13'S	145°14'E	TAS.	16 Jan. 1819
Rodds Bay	RODDS BAY	QLD	24°01'S	151°36'E	2	30 May 1819
Roe River	PRINCE FREDERICK HARBOUR	W.A.	15°11'S	125°32'E	3	13–14 Sept. 1820
Rottnest Island	ROTTNEST ISLAND	W.A.	32°00'S	115°30'E	4	14 Jan. 1822
Round Head	MACQUARIE HARBOUR	TAS.	42°15'S	145°14'E	TAS.	19 Jan. 1819
Sand Point	NORTH GOULBURN ISLAND	N.T.	11°33'S	133°23'E	1	5 Apr. 1818
Sandy Point [=presumably = Spit End]	RODDS BAY	QLD	24°01'S	151°36'E	2	30 May 1819
Seal Island	KING GEORGE SOUND	W.A.	35°05'S	117°58'E	1	20, 29 Jan. 1818
					4	4 Jan. 1822
Shag Islands (see Bird Islets)						
Shark Bay (see Dirk Hartog Island)						
Shelter Bay [=Weary Bay]	SHELTER BAY	QLD	15°54'S	145°22'E	2	26 June 1819
Sight Point[22]	GREVILLE ISLAND	W.A.	15°19'S	124°51'E	4	1 Aug. 1821
Sims Island	SIMS ISLAND	N.T.	11°40'S	133°19'E	1	28 Mar., 2–3 Apr. 1818
					2	13 Aug. 1819
					3	26 Aug. 1820
					4	5–7 July 1821
Smith Island	FAMILY ISLANDS	QLD	18°02'S	146°12'E	2	21 June 1819
Snapper Island	SNAPPER ISLAND	QLD	16°18'S	145°30'E	2	24 June 1819
Snug Cove	TWOFOLD BAY	N.S.W.	37°05'S	149°55'E	1	26 Dec. 1817
South Alligator River	SOUTH ALLIGATOR RIVER	N.T.	12°25'S	132°23'E	1	7–8 May 1818
South Goulburn Island	SOUTH GOULBURN ISLAND	N.T.	11°39'S	133°21'E	1	27 Mar.–1 Apr. 1818
					2	16–17 Aug. 1819
					3	22–25 Aug. 1820
					4	5–6 July 1821
South Island (see Percy Isle No. 1)						
South Repulse Island	REPULSE ISLANDS	QLD	20°37'S	148°52'E	2	8 June 1819
South West Bay	SOUTH GOULBURN ISLAND	N.T.	11°39'S	133°21'E	1	27 Mar.–1 Apr. 1818
					2	16–17 Aug. 1819
					3	22–25 Aug. 1820
					4	5–6 July 1821
Spear Point	PORT ESSINGTON	N.T.	11°19'S	132°09'E	1	22 Apr. 1818
Sphinx Rocks	CAMBRIDGE GULF	W.A.	15°08'S	128°13'E	2	20 Sept. 1819
Spit End (see Sandy Point)						
St Asaph Bay [== Port Cockburn]	MELVILLE ISLAND	N.T.	11°21'S	130°23'E	1	17 May 1818
St George Basin	ST GEORGE BASIN	W.A.	15°23'S	125°02'E	3	11–13 Oct. 1820
Stanley Island	STANLEY ISLAND	QLD	14°08'S	144°14'E	2	14–15 July 1819
					3	9 Aug. 1820
					4	22, 24 June 1821

Collecting locality	Map locality	State	Lat.	Long.	Voyage	Collecting date
Still Bay	CAMBRIDGE GULF	W.A.	15°12'S	128°07'E	2	22 Sept. 1819
Sullivans Cove (see Hobart Town)						
Sunday Island	SUNDAY ISLAND	QLD	11°56'S	143°12'E	2	22 July 1819
					4	27–28 June 1821
Swift Bay	MONTAGUE SOUND	W.A.	14°31'S	125°35'E	3	6–8 Sept. 1820
Table Head (see Table Point)						
Table Point [=Table Head]	PORT ESSINGTON	N.T.	11°15'S	132°11'E	1	24 Apr. 1818
Teal Pond (see Outer Bay)						
The Brothers	SOUTH GOULBURN ISLAND	N.T.	11°38'S	133°21'E	1	1 Apr. 1818
The Gut	CAMBRIDGE GULF	W.A.	15°31'S	128°00'E	2	25 Sept. 1819
The Lump [=Hummock Island]	PORT GEORGE IV	W.A.	15°19'S	124°37'E	4	11–12 Aug. 1821
Thomson Bay	ROTTNEST ISLAND	W.A.	32°00'S	115°31'E	4	14 Jan. 1822
Turtle Bay	DIRK HARTOG ISLAND	W.A.	25°30'S	112°59'E	4	21–25 Jan. 1822
Twofold Bay	TWOFOLD BAY	N.S.W.	37°05'S	149°55'E	1	26 Dec. 1817
Van Dieman Gulf (see May-Day Island, East and South Alligator Rivers)						
Vancouvers' Well	KING GEORGE SOUND	W.A.	34°59'S	117°57'E	1	21 Jan. 1818
Vansittart Bay	VANSITTART BAY	W.A.	14°04'S	126°17'E	2	3–6 Oct. 1819
View Hill	CAMBRIDGE GULF	W.A.	15°11'S	128°07'E	2	19 Sept. 1819
Vine Head [=Myola Bluff]	VANSITTART BAY	W.A.	14°12'S	126°16'E	2	5 Oct. 1819
Water Island	MONTAGUE SOUND	W.A.	14°21'S	125°30'E	3	6 Sept. 1820
Weary Bay (see Shelter Bay)						
West Bay, Middle Island	PERCY ISLES	QLD	21°39'S	150°15'E	4	10–11 June 1821
Yellow Bluff (see River Point)						
York Sound	YORK SOUND	W.A.	14°45'S	125°08'E	3	9 Sept. 1820

1 Presumably the point referred to by Cunningham.
2 Also referred to by Cunningham as Cliff Island.
3 Presumably the beach referred to by Cunningham.
4 Although this locality appears in *Flora australiensis*, Cunningham did not visit here. His journal, however, refers to 'Islands off Cape Pond' which we have determined as Augereau Island.
5 This locality does not appear on present day maps.
6 Presumably the bay referred to by Cunningham.
7 This locality as used by King is 2 km SSE of the Crystal Head marked on present day maps.
8 Specimens ascribed by Cunningham to this locality were collected from the Point Cunningham area.
9 We are uncertain as to the exact locality within Goodenough Bay that Cunningham visited, however, it is perhaps between Murdah and Foul Points.
10 It is presumed that Grassy Hill was revisited on 4 Aug. 1820.
11 On 5 Aug. 1821 a few collections where made on Cunningham's behalf from an island near Greville Island. This site is perhaps 'Gap Island' or 'Lammas Island', these names do not appear on present day maps.
12 This locality as used by King is c. 3 km due E of the Halfway Bay marked on present day maps.
13 Anchored in Sullivans Cove on the Derwent River.
14 Uncertain whether Cunningham collected from this locality.
15 Presumably the island visited by Cunningham.
16 This locality as used by King is c. 8 km NE of the Mount Brookes marked on present day maps.
17 Presumably the mount referred to by Cunningham.
18 Collection made from a rocky islet adjacent to Greville Island in Munster Water.
19 On 14 Jan. 1819 it is probable that Heron Pond and possibly also Teal Pond where visited.
20 Not to be confused with Port of Bowen, 20°04'S, 148°22'E.
21 Cunningham used this name as a general locality description for the area encompassing Bat Island, Caper Point and Careening Bay.
22 This locality does not appear on present day maps.

Appendix II

Chronological listing of Cunningham collecting localities

Place-names in upper case are the collecting localities shown in Figs 1–4. Names in lower case are collecting localities within extended geographic area (see text for explanation).

Voyage 1 (22 Dec. 1817–29 July 1818)

22 Dec. 1817	*Mermaid* departed Sydney (Port Jackson).
26 Dec. 1817	TWOFOLD BAY, N.S.W.
16 Jan. 1818	MIDDLE ISLAND, RECHERCHE ARCHIPELAGO, W.A.: Goose Island Bay.
20–31 Jan. 1818	KING GEORGE SOUND, W.A.: Bayonet Point, Emu Point, French River, Frenchman Bay, Garden Island, Lake Seppings, Middleton Beach, Mount Adelaide, Mount Martin, Oyster Harbour, Princess Royal Harbour, Seal Island, Vancouvers' Well.
15–17 Feb. 1818	BAY OF REST, EXMOUTH GULF, W.A.
20 Feb. 1818	CURLEW RIVER [=Ashburton River], W.A.
23 Feb.–1 Mar. 1818	DAMPIER ARCHIPELAGO, W.A.: Burrup Peninsula, Courtenay Head, East Intercourse Island, Enderby Island, Intercourse Island, King Bay, Malus Island, Marney Bay, Mistaken Island, Rocky Head.
28 May, 2–3 Apr. 1818	SIMS ISLAND, N.T.
5–7 Apr. 1818	NORTH GOULBURN ISLAND, N.T.: Cone Point, Mullett Bay, Sand Point.
12 Apr. 1818	COPELAND ISLAND, N.T.: Mountnorris Bay.
14 Apr. 1818	CROKER ISLAND, N.T.: Palm Bay.
15 Apr. 1818	HIGH POINT, N.T.
17–18 Apr. 1818	RAFFLES BAY, N.T.
20–24 Apr. 1818	PORT ESSINGTON, N.T.: Berkeley Bay, Caiman Creek, King River, Knocker Bay, Mangrove Point, Middle Head, Oyster Point, Record Point, Spear Point, Table Point.
1 May 1818	MAY-DAY ISLAND [=Morse Island], N.T.
6 May 1818	EAST ALLIGATOR RIVER, N.T.

7–8 May 1818	SOUTH ALLIGATOR RIVER, N.T.
17 May 1818	MELVILLE ISLAND, N.T.: Luxmore Head, St Asaph Bay.
25–26 May 1818	BATHURST ISLAND, N.T.: Kanunga Point, Port Hurd.
31 May 1818	Departed N.T. coast for Timor.
14 June 1818	Departed Timor for Port Jackson.
29 July 1818	Arrived in Sydney (Port Jackson).

Voyage to Van Diemen's Land (Tasmania) between voyages 1 & 2 (25 Dec. 1818–14 Feb. 1819)

24 Dec. 1818	*Mermaid* departed Sydney (Port Jackson).
5–9 Jan. 1819	HOBART TOWN [=Hobart], TAS: Derwent River, Mount Table, Sullivans Cove.
13–25 Jan. 1819	MACQUARIE HARBOUR, TAS: Betsey Island, Bird Islets, Channel Bay, Entrance Island, Heron Pond (?), Outer Bay, Pine Cove, River Point, Rocky Island, Round Head, Teal Pond (?).
1–5 Feb. 1819	HOBART TOWN [=Hobart], TAS.
14 Feb. 1819	Arrived in Sydney (Port Jackson).

Voyage 2 (8 May 1819–12 Jan. 1820)

8 May 1819	*Mermaid* departed Sydney (Port Jackson) accompanied by the colonial brig *Lady Nelson*.
11–20 May 1819	HASTINGS RIVER and PORT MACQUARIE, N.S.W. Pelican Point.
30 May 1819	RODDS BAY, QLD: Hummock Hill Island (?), Mangrove Bay, Sandy Point.
3–4 June 1819	PERCY ISLES, QLD: Percy Isle No. 1.
8 June 1819	REPULSE ISLANDS, QLD: South Repulse Island.
9 June 1819	CAPE CONWAY, QLD
10 June 1819	PINE ISLAND, QLD: Pine Head.
14–16 June 1819	CAPE CLEVELAND, QLD: Cleveland Bay.
18 June 1819	PALM ISLANDS, QLD: Island No. 2.
20 June 1819	GOULD ISLAND, QLD: Cartha Island, Rockingham Bay.
21 June 1819	FAMILY ISLANDS, QLD: Smith Island.
22–23 June 1819	FITZROY ISLAND, QLD
24 June 1819	SNAPPER ISLAND, QLD
26 June 1819	SHELTER BAY [=Weary Bay], QLD: Bloomfield's Rivulet, Collins Hill.
28 June–10 July 1819	ENDEAVOUR RIVER, QLD: Endeavour River South Branch, Finch Bay, Grassy Hill, Mount Cook, Mount Saunders, Point Saunders.
14–15 July 1819	STANLEY ISLAND, QLD: Cape Flinders, Mount Dreary.
22 July 1819	SUNDAY ISLAND, QLD: Margaret Bay.
5–6 Aug. 1819	LIVERPOOL RIVER, N.T.
16–17 Aug. 1819	SOUTH GOULBURN ISLAND, N.T.: South West Bay.
13 Aug. 1819	SIMS ISLAND, N.T.
6–7 Sept. 1819	PORT KEATS, N.T.
17 Sept. 1819	LACROSSE ISLAND, W.A.
19–28 Sept. 1819	CAMBRIDGE GULF, W.A.: Adolphus Island, Nicholls Point, Pentecost River, Sphinx Rocks, Still Bay, The Gut, View Hill.
3–6 Oct. 1819	VANSITTART BAY, W.A.: Encounter Cove, Jar Island, Long Island, Rocky Cove, Vine Head.
10–12 Oct. 1819	PORT WARRENDER, W.A.: Crystal Head.
13 Oct. 1819	Departed W.A. coast for Timor.
9 Nov. 1819	Departed Timor for Port Jackson.
12 Jan. 1820	Arrived in Sydney (Port Jackson).

Voyage 3 (14 June 1820–9 Dec. 1820)

14 June 1820	*Mermaid* departed Sydney (Port Jackson).
21–22 July 1820	PORT BOWEN [=Port Clinton], QLD: Mount Flinders (?)
27 July–4 Aug. 1820	ENDEAVOUR RIVER, QLD: Cherry Tree Bay (?). Grassy Hill, Mount Cook, Mount Saunders, Point Saunders.
6 Aug. 1820	LIZARD ISLAND, QLD
9 Aug. 1820	STANLEY ISLAND, QLD: Cape Flinders, Mount Dreary.
10 Aug. 1820	PELICAN ISLAND, QLD
13 Aug. 1820	HAGGERSTONE ISLAND, QLD
14 Aug. 1820	CAIRNCROSS ISLAND, QLD
16 Aug. 1820	BOOBY ISLAND, QLD
22–25 Aug. 1820	SOUTH GOULBURN ISLAND, N.T.: Anyiminali Point (?), South West Bay.
26 Aug. 1820	SIMS ISLAND, N.T.
6–8 Sept. 1820	MONTAGUE SOUND, W.A.: Katers Island (?), Swift Bay, Water Island.
8 Sept. 1820	CAPSTAN ISLAND, W.A.
9 Sept. 1820	YORK SOUND, W.A.: Augereau Island.
11–18 Sept. 1820	PRINCE FREDERICK HARBOUR, W.A.: Hunter River, Mount Brookes, Roe River.
21 Sept.–6 Oct. 1820	CAREENING BAY, W.A.: Bat/Cliff Island, Caper Point, Mount Knight.
11–13 Oct. 1820	ST GEORGE BASIN and PRINCE REGENT RIVER, W.A.
9 Dec. 1820	Arrived in Sydney (Port Jackson).

Voyage 4 (26 May 1821–25 April 1822)

26 May 1821	*Bathurst* departed Sydney (Port Jackson).
10–11 June 1821	PERCY ISLES, QLD: Cockatoo Hill, Percy Isle No. 2, West Bay.
17 June 1821	MISSION BAY, QLD: Bulburra Beach (?), Rocky Island.

20 June 1821	LIZARD ISLAND, QLD
22,24 June 1821	STANLEY ISLAND, QLD: Cape Flinders.
23 June 1821	CLACK ISLAND, QLD
27–28 June 1821	SUNDAY ISLAND, QLD: Margaret Bay.
5–6 July 1821	SOUTH GOULBURN ISLAND, N.T.: South West Bay.
5–7 July 1821	SIMS ISLAND, N.T.
23–24 July 1821	CAREENING BAY, W.A.
26–28 July 1821	PRINCE REGENT RIVER, W.A.: King Cascade.
30 July, 1–4 Aug. 1821	GREVILLE ISLAND, W.A.: Gap Island (?), Halfway Bay, Lammas Island (?), Munster Water, Sight Point.
6 Aug. 1821	HANOVER BAY, W.A.
11–13 Aug. 1821	PORT GEORGE IV, W.A.: Augustus Island, Entrance Island, Point Adieu, The Lump.
27 Aug. 1821	Departed NW coast for Mauritius.
15 Nov. 1821	Departed Mauritius for King George Sound.
24 Dec. 1821–5 Jan. 1822	KING GEORGE SOUND, W.A.: Bald Head, Emu Point, Frenchman Bay, Limestone Head, Mistaken Island, Mount Martin, Oyster Harbour, Seal Island.
14 Jan. 1822	ROTTNEST ISLAND, W.A.: Government House Lake, Thomson Bay.
21–25 Jan. 1822	DIRK HARTOG ISLAND, W.A.: Turtle Bay, Cape Inscription, Cape Levillain.
9–12 Feb. 1822	KING SOUND, W.A.: Cygnet Bay (see text for discussion), Goodenough Bay, Point Cunningham.
25 Apr. 1822	Arrived in Sydney (Port Jackson).

Alexander Morrison (1849–1913) and Edinburgh's botanical connections with Australia

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Abstract

A summary of the life of the Scottish physician and botanist Alexander Morrison is followed by an account of his Australian explorations and plant collections and a brief note on his visit to the New Hebrides (Vanuatu). A number of connections between Australia and the Royal Botanic Garden Edinburgh (E) are noted. Five appendices cover the new taxa described by Morrison, an eponymy, a list of his collecting localities in Victoria and Western Australia, a bibliography of his published works and a list of the Australian collectors who contributed to his herbarium.

Alexander Morrison (1849–1913) was an Edinburgh trained physician who, after emigrating to Australia in 1877, proceeded to make a significant contribution to the study of the native flora, chiefly in Victoria and Western Australia.

His medical education included botany classes given at the Royal Botanic Garden Edinburgh by John Hutton Balfour, who held the then joint posts of Professor of Botany at Edinburgh University and Regius Keeper (Director) of the Botanic Garden. The professor's son, Isaac Bayley Balfour, was a fellow student who subsequently succeeded his father as professor and Regius Keeper.

These formative contacts were sustained by Morrison throughout his explorations in Australia, and undoubtedly influenced his decision to leave his vast herbarium to Edinburgh.

This paper presents a summary of the life and botanical work of Morrison, drawing for the first time on sources in the archive of the Royal Botanic Garden Edinburgh. It is acknowledged to be an incomplete account. Further research at Edinburgh would probably uncover more details of his character and work; furthermore related correspondence must exist at Kew and probably elsewhere, and has yet to be examined.

Over the past 150 years elements of the Australian flora have been studied by a number of botanists connected with the Royal Botanic Garden Edinburgh. With particular emphasis on contemporary researches, the most notable of these are briefly discussed at the end of this paper.

Alexander Morrison: curriculum vitae

An obituary of Morrison (Anon. 1914) provides a fairly full account of his life, and further information is given by Maiden (1921). A synopsis will suffice here, adding some new facts and casting doubt on some others! Further details are also provided by Green (this volume). The only known portrait of Morrison is reproduced in Figure 1.

1849, 15 Mar. Born Wester Dalmeny, west of Edinburgh, son of Thomas Morrison and Anne Peggie. (Source: old parish records, Scottish Register House.) Today there are still Morrisons at Wester Dalmeny.

1866–1869 Edinburgh University Botany Class summer sessions (signature in class registers, E archive). The statement (Anon. 1914) that Morrison went to Australia aged 18 must therefore be wrong.

1871 Melbourne. Collected with J. H. Morrison, specimens at MICH (Vegter 1976). It is stated (Anon. 1914) that Morrison returned to Europe and trained at Glasgow, Würzburg and Vienna: however there is no evidence that he was ever at Glasgow and the Medical Directory implies that he was educated at Edinburgh alone (D. A. Dow, Archivist, Greater Glasgow Health Board and University Archives, pers. comm.).

1873, 9 Jan. Presented to Edinburgh University Herbarium a collection of Australian plants collected by himself in 1871 (*Trans. Bot. Soc. Edinburgh* 11: 474, 1873).

1873, 13 Feb. Balloted as a Botanical Society of Edinburgh Fellow, address listed as 77 Lothian Road, Edinburgh (*Trans. Bot. Soc. Edinburgh* 11: 474, 1873).

1873 Edinburgh University Botany Class summer sessions (signature in class registers, E archive).

1873, Nov. Listed as a resident Fellow of the Botanical Society of Edinburgh, address now 67 Great King Street, Edinburgh (*Trans. Bot. Soc. Edinburgh* 11 appendix D:3, 1873) and continues to be thus listed, though without an address after Nov. 1876, until Jan. 1879 (*Trans. Bot. Soc. Edinburgh* 12 appendix: xi, xxxiii, lxvi, 1876; 13 appendix: xlv, xc, 1879).

1876 Qualified as licentiate of Royal College of Physicians and Royal College of Surgeons, Edinburgh (D. A. Dow, pers. comm.).

1877, 15 Feb. Registered with General Medical Council (D. A. Dow, pers. comm.).

1877 To Australia on SS *Hastings* as medical officer in charge of immigrants: called at Perth on way (visiting and walking back from York) then on to Melbourne (? via South Australia — specimens this year from Gawler.) Locum for 1 year at Ararat Lunatic Asylum (Anon. 1914).

1878 Private practice, 472 Albert Street, E. Melbourne (Anon. 1914).

1884 Member, Field Naturalists Club of Victoria (*Victorian Naturalist* 30: 145, 1914).

c. 1892 Abandoned medicine due to ill health (Anon. 1914).

1896, 1 May Address Beulah, Domain Road, South Yarra (E archive). Made expedition to New Hebrides (ms diary at E, see p. 151 of present paper).

1897, 1 July Botanist, Bureau of Agriculture, Western Australia, £230 p.a. Private address 153 Brown Street, Perth until final letter (24 July 1905) when 149 Brown Street (E archive).

1906, 19 June Post stopped, retiring allowance of £145 19s 3d but no pension. Private practice again, first at Hay Street, then Rokeby Road, Subiaco. Continued voluntarily in botanical pursuits until leaving state (Anon. 1914).

1908 Delivered Museum lecture 'The adaption of plants to their environment' as reported in the *West Australian* of 21 Sept. 1908 (*Nature* 79: 106, 1908).

date? Became vice president Natural History Association of Western Australia (Hooper & Roberts 1966).

1910 Delivered Museum lecture 'Vegetation and rainfall' (Anon. 1914).

1912 Left Perth. To Melbourne as assistant botanist to A. J. Ewart, Professor of Botany and Government Botanist (Anon. 1914).

1913, Feb. Honorary member of Natural History & Science Society of Western Australia (Anon. 1914).

1913, 7 Dec. Died at Heatherton Sanatorium, Cheltenham, nr Melbourne. Buried at Kew cemetery (Anon. 1914).

'He was a painstaking worker, and exceedingly cautious; he was reticent, retiring, kindly in his disposition and scrupulously honest in all his dealings' (Anon. 1914, p. 109). This latter trait led him to comment in a letter to Isaac Bayley Balfour on 24 July 1905:

> With regard to the title of "Doctor" or "MD". You may not know that I did not take the MB when at Edinburgh failing, I understood, in medicine (final exams) which I know better than most other subjects. How far it is applied as a matter of courtesy I do not know and can only accept the compliment gratefully...

The ill health which more than once resulted in his abandoning medicine never seemed to restrict his abounding energy for plant exploration. However, Maiden suggests that it did influence his rate of publication, noting that 'He did not write much, but always effectively . . . he was a charming man, full of information and anxious to impart it, and Australian science has to deplore that the state of his health did not permit him to publish more' (Maiden 1921, p. 164).

Fig. 1. Alexander Morrison c. 1898. This portrait is taken from a group photograph in the archive of the Western Australia Department of Agriculture. It was taken soon after Morrison's appointment to the department. At the time he was consulting botanist to the Mueller Botanical Society (N. G. Marchant, pers. comm.).

Australian exploration and collections

Morrison's Australian botanical explorations were centred on Melbourne and Perth although some specimens are known from Gawler in South Australia: these are dated 1877 and may have been collected on his journey to Victoria. In both Victoria and Western Australia many of his collecting areas follow the lines of the railway. Clearly the railway proved invaluable to Morrison, in his explorations. For example, in a manuscript in the Edinburgh archive he describes a return journey from the Karridale area, in October 1897 in the company of Professor Goebel of Munich: 'During the stoppages made by the train at Boganup and Picton Junction it is possible to secure a good handful of specimens to be found growing in an almost natural condition close to the stations'. He also made extensive collections in the environs of both Melbourne and Perth, areas now completely engulfed by city sprawl.

In contrast with his journey in the New Hebrides, which is exceptionally well documented (see below), he appears to have left only one diary of his Australian explorations. This is most unfortunate since, in addition to the local information that would have been provided, his lucid easy style would have made inter-

esting and entertaining reading. Consider for instance this extract from the one Australian account that does exist:

> The excursion was made from Busselton on the 20th October, on which day it so happened, the coach to Karridale did not run. As the immediate neighbourhood of this quiet town is about as deficient in botanical interest as the town itself is in human interest, we decided to hire a buggy to take us to the Margaret River and to stay at the accommodation house for the night, continuing the journey to Karridale the following day. By this course we secure a day at the Margaret River where the flora is very rich, while being at liberty on the way to make halts for the purpose of collecting wherever we saw a good display of specimens . . .
>
> . . . Before long the rain came down in almost tropical torrents and we were glad to hurry on the horses till the Margaret was reached about one o'clock, by which time we were well soaked and very uncomfortable. The chief comfort at the accommodation house was a good fire at which we were able to partially dry our clothing and get rid of the chill. As the rain continued off and on during the remainder of the day, we could only make short sallies from the hotel to collect specimens, which were of course dripping wet and could not be pressed till freed of all external moisture and that took some time. Flowering plants are found in great profusion here and the locality is a good one at which a few days might be well spent in collecting and studying the Flora, but unfortunately the board and lodging to be had is the reverse of enticing. (Notes of a botanical trip to Karridale; ms. in E archive.)

Unfortunately, he seldom included field notes with his specimens and in many cases the only clue to locality was a small, postage-stamp-sized slip of paper with a cryptic abbreviation and a date. Various people in different places have over the years deciphered these abbreviations. Where known, these are included in the lists of collecting localities given in appendix III. Occasionally, as in the case of *Drosera* or some *Acacia* or *Eucalyptus* species, more detailed notes are provided. He was particularly interested in *Drosera* and corresponded with Bayley Balfour about the genus, sending seeds, bulbs and spirit material to Edinburgh in addition to herbarium specimens. He also corresponded with Diels in Berlin, who was preparing the account of *Drosera* for Engler's *Das Pflanzenreich*. Reference is made in this to Morrison's work (Diels 1906, p.8). Seeds of several other plants were also sent for the garden at Edinburgh. A list of Morrison's published taxa and his full bibliography are given in appendices I & IV.

Throughout his time in Australia Morrison sent specimens to Edinburgh to his erstwhile fellow student Isaac Bayley Balfour, by then Regius Keeper of the Royal Botanic Garden and Professor of Botany at the University. Many of these specimens were then mounted and could immediately be incorporated into the herbarium. (Balfour wrote in 1914: 'we already have in our herbarium many valuable specimens sent by him'.) On his death in 1913 Morrison bequeathed his remaining herbarium to his 'alma mater' Edinburgh University. It seems at first curious that he should not have left his collections in Australia but his letters show a long-standing disillusionment with his employers which may partly explain this. In January 1904 he wrote that 'the government [Western Australia] here are completely indifferent to botany or their botanist — so long as the farmers do not complain about the identification of their weeds nothing else is necessary'. And a year later: 'I began here over seven years ago with the hope of at least laying the foundation of a good herbarium but the indifference and inertia of the government authorities discourages even that'. At this point he was 'ready with loins girt to leave' and had applied for the post of Government Botanist in Melbourne on the death of Luehmann. It was to be another seven years before he did move back to Melbourne but in the meantime the termination of his post in Perth seems to reflect further estrangement with the authorities.

Thus Morrison's large, comprehensive herbarium of both phanerogams and cryptogams came to Scotland and correspondence at Edinburgh shows how Bayley Balfour had to justify to the University court the cost of its transport:

> Dr Morrison's long sojourn in Australia, his great knowledge of its flora and the exceptional opportunities he had of collecting, make his herbarium a really valuable one alike from the educational and scientific standpoint. . .The herbarium was noteworthy in Australia as the finest private collection and it is the best that has come to Europe since the pioneer work on Australian botany early in the last century . . . It is a worthy and noble gift.

After various hold-ups due to the war and a voyage to London on the SS *Ulysses* the collections eventually arrived in Edinburgh in October 1915. They were contained in 29 cases and it had cost £27 9s 10d to transport them. With no records available we can only guess at reasons for the subsequent hiatus. Shortage of staff during the first world war coupled with the arrival from China of the exciting collections of George Forrest must have resulted in many projects being shelved. In 1930 there is notice of receipt by Kew of c. 5,000 Morrison Western Australian duplicates from Edinburgh. At about this time many specimens must have been incorporated into the Edinburgh herbarium. However, many more languished in boxes through another world war until a final assault was made on them in the early 1960s. (The story at Kew seems to be much the same with the duplicates sent from E in the 1930s not being processed until the early 1950s.) Since then, about 9,000 Morrison specimens have been added to the herbarium at E, and about 7,000 surplus (not always strict duplicates) have been distributed to CANB, PERTH, US, AD, MICH and RSA. Vegter (1976) indicates other locations for Morrison collections: B, BM, CORD, GH, L, MO, NH, S, WAG, WRSL. Morrison's herbarium contains many specimens collected by others; these are noted in appendix V.

Expedition to New Hebrides (Vanuatu)

In the winter of 1896 Morrison, at the suggestion of Ferdinand Mueller, made a botanical excursion to the New Hebrides. By the time of his return Mueller had died and his assistant Johann Georg Luehmann had succeeded him at Melbourne. Thus it was with Luehmann that Morrison worked over his plants.

Many manuscript notes compiled as a result of this journey are to be found in the Edinburgh archive. They

are closely but clearly written in ink or pencil on small (c. 22 x 14 cm) sheets. Included is a diary of the journey (1 May-August 1896) and an ink written manuscript 'Notes on a botanising tour in the New Hebrides' with the pencilled addition 'read at meeting of Mueller Botanic Society, September 6th 1897'. This gives a condensed account of his excursions including notes on how he travelled (ship, foot), where he stayed (with settlers and missionaries) and how he gathered his specimens.* The collecting methods used in the humid, lush areas of the Pacific, where some form of artificial heat was needed, are contrasted with those used for 'the rigid spiny plants so common in Australia many requiring to be placed between boards and stood upon to reduce them to a tolerably flat shape'. Newspapers were not available locally and a stock had to be carried. Calico bags, used by the missionaries for exporting arrowroot, proved useful for holding specimens of fruits and other thick objects. Spirit material was also procured — against the advice of Mueller who thought the jars 'a great impediment to travelling' and considered that everything necessary for the study of specimens was available from the dried material.

For much of the first month 'for reasons of health' Morrison remained on the steamer as it plied from island to island on its normal trading operations. This gave him a good 'general idea of the islands, their native races, coastal flora and fauna'. Two longer visits were made to Aneityum and Eromanga.

Aneityum was reached on 3 June and Morrison was fortunate to stay with D. J. Lawrie, manager of the sawmill company who, in addition to offering hospitality, enlisted

> the services of the natives in bringing in specimens from the opposite side of the island and from the higher hills — which they did in a wholesale way by the basket load [until] I was forced in despair of utilising it all to cry Hold! enough!

From Aneityum he moved to Eromanga for a further three weeks.

A much fuller pencil manuscript of his journey, which provides fascinating glimpses into life on the islands, both of the settlers and the natives, is also in the archive at Edinburgh. Short, pertinent sections appear later in ink under such headings as: geological notes on Eromanga; soil on New Hebrides; topography; effects of humid climate; meteorological notes; natives (written on the back of an envelope containing a subscription reminder for membership of the Melbourne Athenaeum!); Dayspring [a missionary trading vessel?]; Eromangan vocabulary; traditions; heathenism; cannibalism; belief in God; sacred stones and carved blocks; native custom; burial of the dead; mourning for the dead; native oven; native pudding; family relationship; marriage; circumcision; population; diseases; notes on different missions *et al.*

Many notes on his collections and on the plants in general are also included with what appear to be details of where duplicates were sent. Few have been found at Edinburgh but correspondence suggests that all the New Hebrides specimens received at E were sent to K. This has been corroborated recently by Dr Philip Cribb who has found over 80 Morrison New Hebrides collections of Orchidaceae at K, representing over 30 species (Lewis & Cribb 1989)*. None has been found at E. They had been studied earlier by Oakes Ames (1933).

* In a letter dated 4 Dec. '89 the senior author noted that P. S. Green has confirmed that Morrison's collection from the New Hebrides is at Kew. At least the bulk of it was not incorporated into the main collections until the 1960s. The flimsies that contained his collections were proof copies of St Matthew's gospel translated into a Melanesian language! (Ed.)

Edinburgh's other Australian connections

Between 1790 and 1795 Edinburgh was the training ground for Robert Brown, who subsequently accompanied Flinders on HMS *Investigator* and made extensive collections of the Australian flora. A set of this material, over 2,000 specimens with distinctive blue 'Iter Australiense' labels, is housed at Edinburgh. It includes many type specimens, and it is probable that many more await detection.

In addition to Brown and Morrison the *Index to collectors in the Edinburgh herbarium* (Hedge & Lamond 1970) contains over 200 Australian entries.

Contemporary research at the Royal Botanic Garden Edinburgh has included three significant contributions to Australian systematics. As part of his world-wide studies of conifers Dr Chris Page has collected wild origin material of all Australian representatives. These are now in cultivation at Edinburgh in experimental glasshouses. Here detailed observations of the various life cycle stages are being recorded and their taxonomic implications assessed. Particular attention is being focused on Tasmanian species, major plantings of which are being established at the Younger Botanic Garden, Benmore, Argyll, one of the Garden's outstations.

In the last twenty years Miss Rosemary Smith has developed an extensive knowledge of the Zingiberaceae and its relatives. She has recently published accounts of the Zingiberaceae and Costaceae in volume 45 of the *Flora of Australia*. In the course of these studies three new species of Zingiberaceae were described from Northern Queensland. B. P. M. Hyland (CSIRO, Division of Forest Research, Atherton) provided invaluable cooperation during the compilation of these accounts.

Since 1974 Dr Roy Watling has been investigating the larger fungi of Australia, with particular emphasis on the families Bolbitiaceae and Boletaceae, and also the genus *Armillaria* (honey fungi). His studies have involved collaboration with many Australian workers, both in the field, as with the exploration of the Cooloola sand dunes in Queensland, and in the laboratory, examining the micromorphology of the spores and chemotaxonomy of the fruitbodies. His co-workers include Dr Glen Kile (Hobart) and Dr R. Hilton (University of Western Australia).

Acknowledgements

Thanks are due to Eona Aitken and Helen Hoy, Royal Botanic Garden, Edinburgh for library research, to Derek Dow, Archivist, Greater Glasgow Health Board and University of Glasgow, Joan Ferguson, Librarian, Royal College of Physicians, Edinburgh, and Jane Jeffrey, Assistant Archivist, Royal College of Surgeons, Edinburgh. We are particularly grateful to Neville Marchant for advice and assistance with localities and for providing the portrait of Morrison, and to Judy West and Philip Short for further information on type localities. The library at Kew kindly provided a copy of Hooper & Roberts (1966).

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The archive at E is only partially catalogued. Most archive material referred to is housed in a box labelled 'Morrison'.

Appendix I

New taxa described by Morrison

Acacia densiflora Morrison, *Scot. Bot. Rev.* 1: 96 (1912). T: Western Australia, E Avon District, Kellerberrin, R. B. Leake (E!).

A. longispinea Morrison, *Scot. Bot. Rev.* 1: 96 (1912). T: Western Australia, E Avon District, Kununoppin, F. E. Victor (E!).

Angianthus acrohyalinus Morrison, *J. Bot.* 50: 167 (1912). T: Western Australia, Globe Hill Station and Minderoo, Ashburton River, October, A. Morrison (E!, K, PERTH).

Calandrinia creethae Tratman ex Morrison, *J. Bot.* 50: 165 (1912). T: Western Australia, Laverton, October, Miss Creeth (BM).

C. schistorhiza Morrison, *J. Bot.* 50: 164 (1912). T: Western Australia, Boulder, September, W. D. Campbell (BM, K, NSW, PERTH).

Drosera bulbigena Morrison, *Trans. Bot. Soc. Edinburgh* 22: 417–418 (1905). T: Western Australia, Coolup, Murray R., R. Helms (K); Wet flats, lower Canning River, A. Morrison (BRI, E!, MEL).

D. occidentalis Morrison, *J. Bot.* 50: 166 (1912). T: Western Australia, Beenup, between Canning and Murray Rivers, November, A. Morrison (PERTH).

Dryandra teretifolia Morrison, *J. Bot.* 50: 279 (1912). T: Western Australia, Kellerberrin, September, R. B. Leake (E).

Duboisia campbellii Morrison, *J. Nat. Hist. Sci. Soc. Western Australia* 2(3): 15 (1906). T: Western Australia, Hannans Lake, Boulder, November; Norseman, Dundas Goldfield, October, W. D. Campbell (BM, PERTH).

Grevillea simulans Morrison, *J. Bot.* 50: 277 (1912). T: Western Australia, Varoo and Mindaroo, Ashburton River, A. Morrison (E!).

G. victorii Morrison, *J. Bot.* 50: 276 (1912). T: Western Australia, Kununoppin, October, F. E. Victor (E!).

Helipterum cirratum Morrison, *J. Bot.* 50: 168 (1912). T: Western Australia, On flat between Globe Hill and Varoo Stations, Ashburton River, October, A. Morrison (E!).

Indigofera boviperda Morrison, *J. Bot.* 50: 166 (1912). T: Western Australia, Ashburton River, A. Morrison (E!).

Isotropis argentea Ewart & Morrison, *Proc. Roy. Soc. Victoria* 26: 157 (1913). T: Northern Territory, 10 miles W of Eva Downs, 19.viii.1911, G. F. Hill 524a (MEL).

Jacksonia anomala Ewart & Morrison, *Proc. Roy. Soc. Victoria* 26: 158 (1913). T: Northern Territory, 18° 27'S, 132°E, 6.vii.1911, G. F. Hill 499 (MEL).

Petalostyles labicheoides R. Br. var. *microphylla* Ewart & Morrison, *Proc. Roy. Soc. Victoria* 26: 160 (1913). T: Northern Territory, 40 miles W of Landers Creek, 23.vi.1911, G. F. Hill 364 (MEL).

Psoralea luteosa Ewart & Morrison, *Proc. Roy. Soc. Victoria* 26: 161 (1913). T: Northern Territory, N of 15°S, -.ix.1911, W. S. Campbell (MEL).

Solanum tetrandrum R. Br. var. *angustifolium* Morrison, *J. Bot.* 50: 275 (1912). T: Western Australia, Ashburton River, October, A. Morrison (BM, E!).

Tephrosia pubescens Ewart & Morrison, *Proc. Roy. Soc. Victoria* 26: 163 (1913). T: Northern Territory, Top Spring, 31.viii.1911, G. F. Hill (MEL).

Appendix II

Eponymy — provisional

Callitris morrisonii R. Baker, *Proc. Linn. Soc. New South Wales* 31: 717 (1907). [= *C. canescens* (Parl.) S. T. Blake)]

Dicrastylis morrisonii Munir, *Brunonia* 1: 485 (1978).

Hakea morrisoniana W. V. Fitzg., *J. & Proc. Roy. Soc. Western Australia* 3: 134 (1918).

Myriocephalus morrisonianus Diels, *Bot. Jahrb. Syst.* 35: 610 (1905). [= *Helipterum craspedioides* W. V. Fitzg.]

Platylepis morrisonii Schlecht., *Fedde Rep. Sp. Nov.* 9: 161 (1911).

Solanum morrisonii Domin, *Biblioth. Bot.* 89: 577 (1929). [= *S. sturtianum* F. Muell.]

'Morrison feather flower' [*Verticordia nitens* (Lindl.) Endl.] commemorates an earlier Swan River settler, not Alexander (A. George, pers. comm.).

Dendrobium morrisonii Schlecht. is named after R. Morrison, a missionary in Anatom, New Hebrides, in 1864.

Appendix III

Collecting localities of Alexander Morrison

Spelling and abbreviations as used by Morrison.

VICTORIA

Aberfeldy River	Mentone
Albert Park	Merri Creek
? Anderson's Creek (Andr Cr)	Mirboo
Ararat	Moe Creek
Bacchus Marsh (B marsh)	Moonee Ponds (M Pds)
Bayswater (B)	Mordialloc (Mord)
Beaconsfield	Mount Buninyong
Berwick (Bwck)	Mount Coranworabal (Mt Coran)
Boxhill (BH)	Mount Dandenong
Brighton (Br)	Mount Eliza
Bunyip	Mount Mitchell
Caulfield	Mount Wellington
Cheltenham (Ch)	Mount William
Clayton's Road	Mueller River
Cleveland Road (Cl)	Munro
Collingwood	Murrumbeens
Croydon (Cr)	Northcote
Dandenong (Dng)	North Esk
Dandenong Hills & Range	North Williamstown (NW)
Darebin Creek	Oakleigh (O)
Emerald	Plenty River (Pl R)
Fernshaw	Port Phillip
Ferntree Gully (FG)	Port Melbourne (PM or Pt M)
Frankston (Fr or Frs)	Preston (?Pr)
Gembrook	Red Bluff
Glenmaggee	Ringwood (R, Rd or Rwd)
Gipps Land	Royal Park
Gipsy Village	Sandridge
Grampians	Sandringham
Hatherley (Hath)	Scotchman's Creek
Healesville (Hv)	Studley Park (St Pk)
Heidelberg	Tarwin River
Hobsons Bay	Templestowe
Kew (K)	Thompson River
Kororoit Creek (Kor Cr)	Upper Werribee River (Up W)
Latrobe River	Walhalla
Laverton (L)	Werribee (W)
Lexton	Western Port
Lilydale	Whittlesae
Macallister River	Yarra Yarra River
Melbourne	

WESTERN AUSTRALIA

Albany (Alb)
Armadale (Arm or Ar)
Arrino
Arrowsmith River
Ashburton River
Avon District
Avon River
Balkra
Barourath
Bayswater (B)
Beenup (Benp)
Bellevue (Bv or Bell)
Beverley
Bioawning
Black Frog
Blackwood River
Boorabin
Boulder City
Boulder Valley
Bowes
Boyanup
Bremer Bay (Br. bay)
Bridgeton
Broomehill
Bullabulling
Bullsbrook (Bb)
Bunbury
Burswood Island
Busselton
Camballing
Canning-Jarra Railway
Canning River
Cannington (C)
Cape Leeuwin
Carnamah (Car)
Carnarvon
Champion Bay
Chapman River
Claisebrook
Claremont (Cl)
Conical Hill (Coni)
Coolgardie (Cg)
Coolup
Coorow
Cottesloe (Ct or Cott)
Cue
Dalton
Dandaragan
Darling Range (Dr)
Darlington (D)
Derby
Dongara
Donnybrook
Drakesbrook (Dr or Drb)
Ebbanowah (Eb)
Ebbano Mill
Ellen's Peak
Fremantle (Fre)
Freshwater Bay
Gascoyne River
Geographe Bay
Geraldton (Gerd)
Gillingarra (Gill)
Gingin (Gn or Ggn)
Globe Hill
Gooseberry Hill (Gh)
Granite Hill
Granite Ridge
Greenmount (Gr or Grmt)
Green's Siding
Guildford (Gd or G)
Hamelin Bay
Hampton Plains Estate
Hannan's Lake
Harvey River
Helena River (Hele)
Helenvale
Henderson's Lake
Highgate Hill (Hg)
Kelmscott (K)
Killernerrin
Kimberley
King George's Sound
King River
King Sound
King's Park (Kp)
Kununoppin
Laverton
Lawlers
Lion Mill (Lm)
Lockier Range
Ludlow
Maddington (Madd or Md)
Mahogany Creek (Mc, Mg or Moh)
Margaret River (Margt R)
Marradong (Marr)
Melville Park (M Park, Mv or Mel)
Menzies
Midland Junction (Mj or Mdj)
Minderoo
Mingineew
Mogumber (Mog)
Mooliabenee
Moore River (Mo)
Mount Barker
Mount Hunt
Mount Melara
Mount Milligam
Mount Narryer
Mount Saddleback (MtSB or Sbmt)
Mount Scratch
Mount Toolbrunup (Mt Tool or Toolmt)
Mundarring (Md)
Murchison River
Murray River (Mr)
Nagade
Nanutarra
Narrogin (Nrgn)
Newcastle
New Norde
Northam (Nh)
Northampton
Onslow
Perth (P)
Picton (Pt)
Pingelly
Pinjarrah (Pj)
Plantaginet District
Port Hamelin
Queens Park
Quindalup
Red Gum Pass (Rgp)
Sampsons Brook (Sb)
Sandhill
Shark's Bay
Smith's Mill (Sm M or Sm)
Solomon's Well
Southern Cross (Sth X)
Stirling Range (St)
Subiaco (Sub or S)
Sussex District
Swan River
Swan View (Sv or Sw)
Tenterden
Toll's Creek
Uaroo
Vasse River (Vr)
Victoria District
Victoria Park (VP)
Wagerup
Wagin
Walkaway
Warrangup
Hotham River
Irwin River
Israelite Bay
Janebrook
Jarrahdale (Jrdle)
Kalamunda (Km)
Kalgoorlie
Kamballie
Karridale (Kd or Karr)
Kattenning
Kellerberrin
Watheroo (Wath)
William's District
Wongan Hills (Wh or Wg)
Wooroloo
Yandanooka (Y)
Yandoo Brook
Yetermerup (Yet)
York
York District

Appendix IV

Bibliography of Alexander Morrison

1894a New Victorian microfungi. *Victorian Naturalist* 11: 90–91.

1894b Notices of Victorian fungi, concluded. *Victorian Naturalist* 11: 119–120.

1897a The poison plants of Western Australia part 3. *In* L. Lindley Cowan (ed.), *The West Australian settlers guide and farmers handbook*. (Bureau of Agriculture: Perth): pp. 573–592.

1897b New Hebrides. *Gard. Chron.* ser. 3, 21: 300, fig. 102 — [photo of *Agathis obtusa* & a figure that may be Morrison].

1898 Mar. a Economic aspect of the flora of Vasse. *Producers gazette and settlers record of Western Australia*, 175–178.

1898 Mar. b Native poison plants. *Producers gazette and settlers record of Western Australia*, 214–218 [MS. in archive at E].

1898 Apr. The pawpaw. *Producers gazette and settlers record of Western Australia*, 292–294 [MS. in archive at E].

1898 May Salt bushes and their cultivation. *Producers gazette and settlers record of Western Australia*, 359–360 [MS. in archive at E].

1898 Nov. Some plants found growing at the mouth of the River Yarra and at Werribee. *Victorian Naturalist* 15: 87–88.

1898a The botany of Australia. *Western mail*, Christmas number [MS. in archive at E].

1900a The vegetation of Western Australia. *Western Australian year book* 1898/99, 197–225. [MS in archive at E].

1900b Our native salt bushes. *J. Dept. Agric. Western Australia* April: 26–30; May: 19–23; June 66–69 [MS. in archive at E].

1902 The natural features of the New Hebrides. *In* H. A. Robertson *Erromanga, The Martyr Isle.* (Hodder & Stoughton: London). pp. 449–463 [MS. in archive at E].

1903a The vegetation of Western Australia. *Western Australian year book* 1900/01, 1: 298–307.

1903b List of extra-tropical plants. Prepared by F. Mueller, revised and augmented by A. Morrison. Notes on the natural history of Western Australia. *Western Australian year book* 1900/01, 308–341.

1905a A new west-Australian plant, *Drosera bulbigena* A. Morrison. *Trans. Bot. Soc. Edinburgh* 22: 417–418.

1905b Note on the formation of the bulb in the Western Australian species of *Drosera*. *Trans. Bot. Soc. Edinburgh* 22: 419–424.

1906a New species of *Duboisia*. *J. Nat. Hist. Sci. Soc. Western Australia* 2(3): 15.

1906b Flora. *Western Australian year book* 1902–04, 141–143.

1907 Further note on Australian tuberous droseras. *Trans. Bot. Soc. Edinburgh* 23: 236–237.

1910 The adaptation of plants to environment. *J. Nat. Hist. Sci. Soc. Western Australia* 3: 1–11.

1912a New or imperfectly described species of *Acacia* from Western Australia. *Scot. Bot. Rev.* 1: 96–99 (repeated in *Trans. Bot. Soc. Edinburgh* 26: 51–56, 1913).

1912b New and rare West Australian plants I. *J. Bot.* 50: 164–168; II. 50: 275–279.

1913 (with A. J. Ewart). Contributions to the Flora of Australia 21. Flora of the Northern Territory (Leguminosae). *Proc. Roy. Soc. Victoria* 26: 152–164.

Additional archive manuscripts (at E):
Notes on a botanical trip to Karridale in 1897.
Review of A. R. Wallace (1893) Australasia.
Review of Coville, Botany of Death Valley expedition.
New Hebrides manuscripts (referred to in text).

Appendix V

Collectors who contributed specimens to E via Morrison's herbarium

Adams, R.	W.A. 1899
Brooke, I. P.	W.A.
Brown, Maitland	W.A. 1897
Campbell, W. D.	W.A. 1899–1901
Conigrave, C. P.	N.S.W. 1899
Dalton	W.A. 1897
Gregory, J. H.	W.A. 1900–01
Hann, F. H.	W.A. 1902
Helms, R.	Vic. 1891, W.A. 1896–99
Hutchinson, E.	W.A. 1909
James, C. R.	W.A. 1909–10
Kelso, E.	W.A. 1900–02
Lankester, A. E.	W.A. 1897
Lea, A.	W.A.
Leake, R. B.	W.A.
Newman	W.A. 1899
Tyson, I.	Qld 1897, W.A. 1899–1910
Vaughan, A. C.	W.A. 1902
Victor, F. E.	W.A. 1899–1912
Vines, F. B.	W.A. 1898
Webster, L. C.	W.A. 1901
Wellstead, I.	W.A. 1897–1898

Approximately 300 Australian collectors are represented at E. Hedge & Lamond (1970) have documented the collections obtained up to 1970.

Moving mountains — Allan Cunningham and the mountains of southern Queensland

Ian R. H. Telford

Australian National Botanic Gardens, Canberra, A.C.T.

Botanist-explorer Allan Cunningham (1793–1835) played an important role in the exploration of what is now south-eastern Queensland, naming a number of major topographic features. It is evident from his journals and correspondence that later surveyors and cartographers transposed some of his names. This has repercussions for type locality citation, species lists and floras.

The search for Mount Warning (July-August 1828)
The true position of Cook's Mount Warning in the confusing mountain mass south of Brisbane puzzled Cunningham and Captain Logan, Commandant of the Moreton Bay penal settlement. Cunningham had clearly seen Mount Warning from his vantage point near the Great Dividing Range east of the Darling Downs on his famous expedition of discovery in 1827. However, from Brisbane the view was obscured.

In December 1828, an exploring party under the command of Logan and including Cunningham and Charles Fraser journeyed south from Limestone Hills in search of Mount Warning. Their investigation of the position of Mt Warning and the names given to other peaks in the vicinity is described in Cunningham's report, dated 16 December 1828, to Lieutenant-Governor Darling.

> The occupations of Mr Fraser, the Colonial Botanist (whom Your Excellency was pleased to permit to accompany me to Moreton Bay) and myself, for some period after our arrival at that settlement upon the Brisbane, investigating the vegetable productions which so highly invest the banks of that river, did not permit me to prepare for a journey suggested by that excellent commandant, Captain Logan, towards the Mount Warning Ranges, until nearing the end of the month of July.
>
> It was originally our design to penetrate no further to the southward than the base of the Colossean Range, in which Captain Logan still considered the peak of Mount Warning was situate . . .
>
> With considerable exertion, I climbed to a point in elevation equal to one-third of the extreme altitude of the mountain, when the face became so singularly precipitous, and in consequence the further advance attended altogether with so much danger that I deemed it prudent to proceed no further . . .
>
> Whilst I was occupied taking a set of interesting bearings to points around not previously seen, our indefatigable commandant and Mr Fraser . . . continued their journey to the summit . . .
>
> The cone of Mount Warning, respecting the true situation of which we were divided in opinion, I was gratified in no ordinary degree to see distinctly, amidst a group of mountains nearer the coastline.
>
> The mountain which we had visited . . . was named "Mount Lindesay" as a compliment to the officer commanding his Majesty's 39th Regiment in this colony.
>
> At SSE five miles a very precipitous rocky head, in figure seemingly inaccessible from any point around us, was named "Mount Hooker", in honour of the mutual friend of Mr Fraser and myself, the very learned and scientific Regius Professor of Botany in the University of Glasgow.[1]

Transposition of Cunningham's place names
In preparation for the separation of the Colony of Queensland from New South Wales in 1859, a Surveyor Bennett drew up a map of the proposed borderline between the colonies. Apparently transposition of Cunningham's names first occurred here (Groom 1947, Steele 1972).

Cunningham's 'Macpherson's Range' ran NW from Mt Glennie to Tamborine. Bennett applied it to the broken mountains running E-W from Point Danger to Wilsons Peak. Cunningham's name Mount Hooker was dropped and Mount Lindsay (sic) used in its place. The 'Mount Lindesay' of Cunningham became Mount Barney.

Repercussions for botanical data
Thus, collections by Allan Cunningham and Charles Fraser (N.S.W. Colonial Botanist) in 1828, and by Walter Hill (Superintendent of Brisbane Botanic Gardens, later Colonial Botanist of Queensland) in the 1850s-1860s, that are recorded as having come from Mount Lindesay are in fact from Mount Barney. This includes the type specimens of *Acacia brunioides* Cunn., *Bossiaea rupicola* Cunn., *Casuarina rigida* Miq., *Cyathea lindsayanum* W.Hill, *Helichrysum lindsayanum* Domin, *Hovea acutifolia* Cunn. and *Monotoca patens* Cunn.

Cunningham's collection lists from southern Queensland, sent to William Hooker at Kew, are similarly effected by the transposition of the names of landmarks referred to above.[2]

Notes

1. Mitchell Library, Sydney; Governor's Despatches A 1203.
2. Lists are available on microfiche through the Australian Joint Copying Project and are located in many State and Commonwealth libraries.

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Domin and Daneš in Java and Australia 1909–1910

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Abstract

Karel Domin, a botanist, and Jíri Daneš, a geologist, travelled to Australia from Czechoslovakia by way of Java and Ceylon in the years 1909 and 1910. This paper gives information on their itineraries while in Java and Australia.

Voyage to Java

After thorough preparation Karl Domin (Fig. 1) and Jíri Daneš set out in 1909 for an expedition to Java and Australia which was to last for 15 months. They left Czechoslovakia on 25 July 1909 sailing via Port Said. On arrival in Bombay on 18 August they went on a three-day excursion to Hyderbad (Ellory). From Bombay they travelled to Colombo arriving on 28 August. They then travelled via Penang to Singapore where they spent 13 days before travelling on to Sumatra.

Three months in Java

They arrived in Java on 10 September. Daneš devoted himself to the investigation of the limestone regions on the central southern coast of Java. On 15 September Daneš went on to Djokjakarta and after three preliminary excursions in the area left for Wonosari. Domin, meanwhile studied the renowned Botanical Gardens of Buitenzorg, south of Batavia, and the vegetation throughout the island of Java.

Both Domin and Daneš set up their headquarters in Buitenzorg as it had a healthier climate than Batavia and was where the seat of the Governor-General was. As Malay was generally spoken throughout the whole of the Indonesian Archipelago, both learnt sufficient Malay to be understood.

On 17 October they left by rail to Tjandjoer, then by wagon to Sindanglaj and then on foot, with a couple of carriers, up the side of the volcano Panggerango to the rim of its ruined crater at 3,030 m. They also ascended a neighbouring volcano, Gadah, which had a more recent crater.

On 31 October they began an excursion into the volcanic region east of Buitenzorg and ascended the Tangkoeban, which had a small boiling lake, and Papandajan with a huge crater at 2,600 m.

In the latter half of November Domin and Daneš crossed central and eastern Java and made another difficult tour into the volcanic mountains of Tengger. They crossed the country at the foot of the highest Javanese volcano, Semeroe (3,676 m), which had erupted violently shortly before their arrival.

Domin and Daneš in Australia

Domin and Daneš left Java (Soerabaje) on 1 December 1909 and, after stopping for a few hours in Macassar in the Celebes (on 3 December) and at Dobo in the Aroe Islands (on 7 December), proceeded to Port Kennedy on Thursday Island in the Torres Strait. Daneš says on 9 December: '... glimpsed on the eastern horizon rocky islands of the Torres Straits. Spent the night anchored in front of a narrow passage to Thursday Island.'[1] The following morning '... at sunrise raised anchor and around 8 am stopped at Port Kennedy on Thursday Island. Left same afternoon. Rounded Horn Island towards the south and soon saw Cape York'.

At lunch time on the same day they sailed through a narrow strait between Albany Island and the mainland. They then travelled by steamer southward along the Australian coast, arriving in Townsville on 13 December and spending the morning on Magnetic Island. On 16 December they arrived in Brisbane: 'At sunrise saw Morcton and Bribie Islands. Stopped for a short time, then were guided by a tug boat upstream up the Brisbane River'.

In Brisbane they stayed at Lennon's Hotel in George Street. Domin met both F. M. Bailey and John Shirley DSC, and he and Daneš visited Mr McDermott, a min-

Fig. 1. Signed photograph of Karel Domin. Taken in 1910 shortly after his return from Australia.

Fig. 2. John Shirley, Queensland School's Inspector, Jiri Daneš and Karel Domin. Taken during an excursion to the Tambourine Mountains in March 1910.

ister in the Queensland Government, who gave them a letter of introduction.

Having briefly seen Brisbane and environs they left on 24 December for North Queensland, travelling by the morning train to Bundaberg. Next day, Christmas Day, they travelled by rail from Bundaberg to Gladstone, arriving shortly before lunch. They then boarded the USS *Bingera* in the late afternoon and arrived in Mackay in the early evening of 26 December, having passed through the Whitsunday Passage overnight. Next morning saw them anchored in Port Denison Bay at Bowen. They left the USS *Bingera* later that day in Townsville harbour, boarded the *Kuranda* in the afternoon and arrived at Lucinda Point by sundown. They took on mail at Innisfail, after proceeding through Hinchinbrook Strait overnight, and arrived at Cairns on 28 December. In Cairns Domin and Daneš stayed at the Strand Hotel, headquarters for the next part of their journey.

Near Cairns they visited several goldfields, spending most time at Palmer Goldfields, and ascended Mt Bellenden Ker to 1,579 m. New Year's Day 1910 was spent on the summit of the mountain, descent being very difficult as the wet season had set in (Chapman 1986, Domin 1910b). For some time they stayed at the Bellenden Ker Hotel at Harvey's Creek, a small settlement, using it as a base to explore the geology and vegetation of the area. It rained every day. On one of these excursions Domin got lost and did not find his way back to Harveys Creek until late at night. On another occasion he jumped over some water to what he took to be some red sand, only to find it was *Azolla rubra* growing on a water-hole. He ended up jumping right in and the fern closed over his head.

Domin and Daneš made many excursions from Harvey's Creek, including a two day trip to the mouth of the Russel River delta. Here they met Aborigines living in the area and participated in a corroboree ('korobori') and bought ethnographic objects (Stehule 1928). On the second day of the trip they walked to Picnic Creek. After an unspecified time Daneš left Harveys Creek and stayed some time in Nelson. One

Sunday, accompanied by an aborigine, he climbed Walsh's Pyramid. On the following Tuesday he left Nelson on horseback for Goldsborough where he stayed with a Mr Allen until Saturday when he returned to Nelson.

Around the middle of January Domin left Cairns for the aboriginal mission station of Yarrabah. Some time during the next ten days he took a boat trip from Yarrabah to Rocky Island and on to Cape Graton. Bad weather delayed Domin for ten days at Yarrabah where he studied the life of 'civilised' aborigines and made the acquaintance of their chieftain 'King John'. Domin wrote extensively on the mission and on the Aborigines of the area, making particular reference to the miserable attitude of the head of the mission, the Rev. Morrison. (Daneš & Domin 1913; Domin 1914b). On the eleventh day (28 January) the food had run out so Domin joined an emergency rescue mission to Cairns on horseback. The appalling journey took ten hours.

At last the unending rain obliged Domin and Daneš to leave together for the drier interior where they explored the limestone caves around the town of Chillagoe and the vegetation near the crater lake, Lake Eacham. They travelled via Mareeba, Tolga, Atherton, Yungaburra, Chillagoe, back to Tolga and to Yungaburra again and then on to Lake Eacham. They travelled most of the time in the rain.

Before finally leaving Cairns, Domin and Daneš visited the grand canyon and falls of the Barron River south west of Cairns, and the upper Mulgrave River. They left Cairns for Townsville on 15 February on the steamer *Murilyan* (the Cairns to Townsville railway was not built until 1923). Domin reported that:

> ... in the strait of water between Magnetic Island and Cape Pallarenda some ships and sailing boats set sail and in the distance shimmer like great white wings. The mainland itself is, in this direction, absolutely flat; and is indeed called 'Town-Commons' because it is so flat, and at present after the rain is budding with new green grass. Only the low hump of Mount Manypeaks still has some of its slopes covered with flowering gum forests.

While in Townsville they climbed Castle Hill near the centre of the city and made a visit to Cape Cleveland.

On the morning of Monday 21 February Domin and Daneš left Townsville and travelled by rail westward to the goldfield town of Charters Towers, where they had 'a pleasant evening' at a local club. They left by train for Hughenden, arriving on 26 February and taking accommodation at the Central Hotel. From Hughenden they made many excursions, on horseback and foot, and sometimes with an Australian tracker. A visit to Mt Walker, south of Hughenden, on foot, was much further than they had thought:

> ... We pressed doggedly on up through grassy plains covered in splendid grass. We streamed with sweat and our photographic equipment and botanist's knapsack seemed to get heavier. Nature seemed to be playing tricks on us. Our goal, the flat, slab-like spine of the not high Mt Walker lay as it were almost at our fingertips and yet, the longer we walked the more it seemed to elude us. Australians (even the women) are as if joined together with their horses and when they cross a seemingly endless plain they seem unable to judge what sort of distance it could be for someone on foot.

Another excursion was to the Great Dividing Range west of Pentland and the sandy watershed at Burra. Domin described this area as being 'quite romantic and wild in appearance' and as 'a low sandy mountain range with deeply cut gorges, great water-smoothed sand saddles and thick, dry acacia forests which, for the most part, grow together with barely penetrable undergrowth'. He went on to say that they travelled firstly through

> eucalypt forests, then through especially unusual thickets with many yellow and red flowers and finally onto wild sandy territory which resembles, to some extent, Czechoslovak Switzerland. It does not, however, have such narrow, wild gorges and instead of pine and fur forests there are primeval thickets of tall acacias with a few scattered flowering eucalypts.

Domin and Daneš had came to an agreement with the station master at Hughenden that the train would stop at the place that would be most convenient for them to set off from, and that a train would stop at the same place on the way back to pick them up. Domin noted that west of the range the eucalypt forest gave way to the so-called 'scrub':

> By scrub (pronounced skrab) is meant in these parts uneven thickets of small, thick shrubs which reach the maximum growth that drought resistant plant attain. For the most part an unusually high proportion of acacia species make up these thickets which do not contain the thick, grassy undergrowth of the savannah forests seen further east.

They also had a botanically fruitful excursion of two days to Pentland and its surroundings. The result of the 1898–1902 drought were still obvious, particularly between Prairie and Pentland, where there was 'not one drop of rain in three years'!

> There died not just single shrubs and trees, but even whole areas of forests in different parts of the country. The area between Pentland and Prairie gave us an especially useful opportunity to study these phenomena.
>
> The trees in the flowering eucalypt forests and the acacia shrub forests are extremely drought resistant and can stand a number of months without rain in normal circumstances. They could not, however, withstand a whole year of terrible drought, during which the last traces of water in the lowest layers of earth where these roots could barely reach, disappeared. And so, not just single trees or even clusters of trees died out, but in parts whole forests on vast areas of land had died out and had not yet revived [eight years later]. Even today their bleached roots with their faded branches protrude out of the grassy plains. These truly dead forests, dreadful and gloomy, arouse unhappy memories in the minds of everyone who comes across these hostile parts.
>
> It is, however, amazing that some trees, and in some parts, whole forests which after eight years showed not the slightest signs of life, revived, sprouted new branches and then around the long dry branches which sadly spread up the skies, a new green crown grows. Surely a truly rare example of toughness in the plant kingdom.
>
> During the above mentioned drought, conditions for trees and shrubs sank below the minimum required for life. These extremely drought resistant plants struggled tenaciously with death and during this time quite insignificant advantages made themselves known, so insignificant that they would surely have passed the notice of most observers. For example, in the smallest hollows,

barely perceptible to the observer, in slightly better soil or because of its physical composition, a soil which retained the moisture better, the percentage of dead trees was far smaller, and if these advantages were even slightly more noticeable, whole areas of forest in the midst of the dead eucalypt and acacia forests, were saved.

Acacias have even more modest requirements than eucalypts and because of this are tougher. In some places in eucalypt forests which had not yet been able to regenerate, various acacia species multiplied into whole forests of bushes. Thus we see how the influence of years-long drought was to make one species of plant succeed at the expense of another.

From Pentland Domin and Daneš travelled on horseback to Mt Remarkable, stopping at an old abandoned mining settlement on the way. They climbed to the top of Mt Remarkable and then chose a different route to Pentland. Another excursion from Hughenden was to Cloncurry, where rain stopped them from going further west. They then decided to go to Winton. From Winton they travelled, in a large wagon, across the grass plains and scrub via Young's Pub, where they spent the first night, Eversham, Sandy Creek, and Maneroo station before reaching Longreach late at night. It took them four days. They were only able to travel a short distance on the third day as they were stopped at several flooded creeks. On reaching Longreach they stayed at the Imperial Hotel.

From Longreach, the terminal station of the Central Railway of Queensland, they travelled to Barcaldine (on 10 March) and on to Jericho where they made many plant collections. From there they travelled to Rockhampton by night train and stayed at Birch's Criterion Hotel. They then went on to Brisbane, arriving in mid March, and again staying at Lennon's Hotel. Both gave lectures to the Royal Society while in Brisbane, Domin's being on 10 April (Domin 1910a). Domin spent some days arranging his specimens while in Brisbane.

After further excursions, including one of a week's duration to the Tambourine Mountains with John Shirley (Fig. 2), a one day trip to Beech Mountain, and a final one to Stradbroke Island, Domin departed for Sydney and Melbourne in mid-April. After some time in Sydney, he then made a trip, of several days, by train to Katoomba, Wentworth Falls and the Jenolan Caves. On 21 April he arrived in Melbourne and stayed at the Menzies Hotel until 26 April. The stay cost him £4 7s 8d. He made one minor excursion to Cheltenham and visited the Royal Botanic Gardens.

Domin returns to Prague

Domin left Melbourne on the P. & O. steamer *Morea* and arrived back in Prague towards the end of May after stopovers in Adelaide, Fremantle, Colombo, Paradinya, Kandy and Aruredhapura. News of the death of King Edward VII was received on board shortly after leaving Australia and Halley's Comet could be seen clearly before sunrise. 'It glowed very brightly and its tail increased in length and width every night'.

Daneš stays in Australia

Daneš, meanwhile, set out on another long journey to western and northern Queensland. By this time the dry season had begun. On that interesting, though difficult expedition, he studied the morphology and geology of the country, the development of its river systems, its lakes and the limestone regions of these remote parts of the continent. On 14 April he left Brisbane, visiting on his way to the north Baramba, the State Settlement for natives, west of Gympie, and the small limestone region (including the Olsen Caves) north of Rockhampton. From Rockhampton to Barcaldine he went by the great Central Railway, taking 24 hours and next day travelled by coach to Aramac to the north — a journey of seven hours. At Aramac he bought two horses and rode 600 km to the north, across a territory of grass plains and acacia scrub with artesian wells and sheep and cattle farms, often sleeping under the open sky. Crossing the low watershed he explored several salt-lakes, Lakes Mueller, Barcoorah, Dunn, Galilee and Buchanan, some of them without an outlet, as well as their confluences, the creeks and fresh-water springs, studying all the while the life of the white ranchers. To reach Fleetwood Station he had to wade across Lake Galilee for 5 km. Daneš followed the Cape River from Blair Athol to Pentland on the Northern Railway, reaching there on 11 May.

He spent three days in Hughenden and wrote that he was quite satisfied with his three weeks solo journey. From Hughenden he went east again to Prairie where he was the guest of Mr Chisolm on his property, The Plains. While there he took a three day circular trip to Galah Creek Station, Wougalei Station and Glendower Station and arrived back at The Plains by moonlight.

Next day he travelled to Charters Towers and took a trip to The Rocks on the Burdekin River. He then caught another train and travelled onto Cloncurry, the westernmost station. From Cloncurry Daneš continued by mail-coach to Camooweal, a frontier-town of Queensland on the border with the Northern Territory. The trip took five days. He stayed overnight in Camooweal and spent the next three days riding around the countryside with Mr Glissen, manager of Rocklands Station. He spent the weekend studying the Nowranie Cave 19 km southwest of Camooweal.

Having finished these studies he went by mail-coach northeastwards for four days to Gregory Downs. Daneš spent one day at Gregory Downs and then hired a buggy for a six day excursion. He covered about 60 km on the first day and on the second day camped near Mended Hill, not far from the Lawn Hill mines. On the third day he travelled past Lawn Hill Station and went about 20 km further north. On the fourth day he travelled south through a wide valley which was later named Daneš Valley by Lionel C. Ball in his book *The Burketown Mineralfield.*[2] On the sixth day Daneš returned to Gregory Downs.

Next day he boarded the mail-coach and went on to Burketown, a mining town on the Gulf of Carpentaria. From Burketown he travelled east through the lowlands bordering the gulf, again by mail-coach, crossing the lower Flinders to Normanton, a trip of three days. He continued by rail to Croydon, by mail-coach to Charleston by way of Georgetown and by the Northern Railway to Almaden where he stayed overnight before catching another train back to Cairns, arriving on 1 July. From Cairns he took a one day trip to Nelson and then spent a few days based at Kuranda, exploring in detail the canyon and falls of the Barron

River. On 9 July he departed from Cairns on the steamer *Murilyan* for Brisbane, where he stayed for ten days and gave two scientific lectures. He then paid brief visits to Sydney, the limestone region of the Jenolan Caves, Melbourne, and Adelaide (travelling by train on each occasion). In August Daneš went by P. & O. steamer *Morea* to Fremantle and Perth. For a fortnight he explored the limestone region near Yallingup, south of Perth, and the interior goldfields of Coolgardie, Kalgoorlie and Leonora. Daneš then returned to Europe, leaving Fremantle on 5 August aboard the P. & O. steamer *Marmora*, and travelling by way of Ceylon, Aden, Port Said and Trieste. He arrived in Prague on 11 October 1910.

Domin and Daneš — their later lives

In 1926, at the age of 34, Domin became Professor of Botany at the Karlovy University in Prague. He retained the position until the University's closure in 1939. When it reopened in 1945 he relinquished the chair and later became the University's chancellor. Domin died in Prague in 1953, aged 71. Throughout his life he was a prolific writer, publishing 889 papers between 1901 and 1949. For 22 of those years, from 1923 to 1944, he averaged over 27 papers per year, or more than one per fortnight.

Daneš was appointed Assistant Professor of the same University in 1912. He came back to Australia in 1921 and served a period of three years as his country's Consul to Australia in Sydney.

Most of Domin's collections are housed at the Department of Botany, National Museum in Prague (PR). His Australian collections are housed separately in the order of Domin 1914–1915 and Domin 1921–1929. Daneš Australian collections are few, and mainly cover those areas not covered by Domin. They are housed with the Domin collections at PR, or separately at the university herbarium (PRC).

Acknowledgements

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Notes

1. All quotations in this paper are passages, translated in to English, from Daneš and Domin (1913).
2. I have not seen this book and its date of publication has not been ascertained. It is referred to by Daneš and a copy apparently exists in the Prague University Library.

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Retracing the botanical steps of Leichhardt and Gilbert in June 1845

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Abstract

Ludwig Leichhardt and John Gilbert travelled over harsh and inhospitable country until they reached the confluence of the Lynd and the Mitchell Rivers on 15 June 1845. They then turned west and followed the Mitchell River until about 24 June, when they altered course and soon crossed the Nassau River near which John Gilbert was speared to death on the evening of 28 June, whilst camped on the edge of one of the many lagoons in this area.

The route taken by Leichhardt was retraced in October 1985 and the present vegetation compared with the diary entries. The description of the vegetation, in the vicinity of the lagoon where they camped on that fateful night, enabled this lagoon to be located and subsequently the site of Gilbert's grave was found.

In late September 1844, a party lead by Dr Ludwig Leichhardt (Fig. 1), left the Darling Downs in an attempt to find an overland route to Port Essington on the Cobourg Peninsula. In October 1985, another expedition was provisioned. This one set out from Townsville to retrace the steps of the party from 16 June 1845 until the death of John Gilbert on 28 June 1845. The aims of this expedition were: to locate the lagoon where Gilbert had been speared and subsequently interred; and to try and understand something of Leichhardt as a person. Did he deserve the bad press and the criticisms that he has received? Was he a bad leader, autocratic and unable to take advice? Was he a bad navigator who bumbled around the bush? It must also be remembered that this was the first of three expeditions by Leichhardt. A team of University personnel lead by Professor Brian Dalton of the History Department, James Cook University, accompanied Captain Justin Dwyer and members of the 2/4 RAR, on the 1985 expedition. This expedition was mounted by the Australian Army as part of their Adventure Training programme.

When Leichhardt left the Darling Downs he proposed going northward along the Great Divide keeping close to the upper reaches of such rivers as the Isaacs and Burdekin until he came to a river flowing westward at the latitude of the Gulf. He would then follow the river to its mouth. Then he would proceed around the bottom of the Gulf and across to Port Essington. The trip was supposed to last six months. They took with them bullocks which were to provide fresh meat to supplement the game caught en route and to act as pack animals. The bullocks, although fulfilling both these tasks, slowed them down considerably. Two of the original party left the expedition in late October and returned to the Darling Downs. The remaining members of the party were: Ludwig Leichhardt, who had some scientific training, kept notebooks (Leichhardt 1845) and sketched each day's travel; John Gilbert, a self taught ornithologist, kept a daily diary (Gilbert 1845); James Calvert, chief cook and apparently good at small talk; John Roper, who sent a long letter to John Gould who was Gilbert's patron, had a silent disposition according to Leichhardt; William Phillips, a ticket of leave convict, liked his comforts and was apparently 'singular in his habits' (Leichhardt 1847); John Murphy, about 16, who had a happy disposition; Charley, an aboriginal who was a late riser, and Brown, also an aboriginal who was fond of spinning yarns. Until the end of June 1845, the routine was to ride for some 4–5 hours or until a suitable campsite was found near fresh water (average 5–9 miles) then as Leichhardt writes 'during the afternoon everyone follows his own pursuits, such as washing and mending clothes, repairing saddles, pack saddles and packs; my occupation is to write my log, and lay down my route, or make an excursion in the vicinity of the camp to botanize, etc., or ride out reconnoitring'(Leichhardt 1847).[1] If the animals were too footsore or meat had to be dried then the party would spend 2–3 nights if necessary at the same camp.

Thus, by 4 May 1845, after seven months travelling, they had only reached 18°44'S where they 'discovered an extensive valley with large lagoons and lakes, and a most luxuriant vegetation.' (4 May). This was the area now known as the Valley of Lagoons. They continued to travel in a northerly direction crossing various basaltic outcrops and rocky granitic ridges as they tried to find a way across the Great Dividing Range and the object of the expedition i.e. a river flowing westward. Leichhardt seemed fascinated by the variety of different Proteaceae that he encountered on these rocky ridges. These included *Hakea arborescens* R. Br., *H. lorea* (R. Br.) Benth., *Grevillea dryandri* R. Br., *G. mimosoides* R. Br., *G. parallela* Knight, *G. pteridiifolia* Knight, *G. striata* R. Br., and *Xylomelum scottianum* (F. Muell.) F. Muell. The common eucalypt occurring along the streams and in the open forest was the narrow-leafed ironbark (*Eucalyptus crebra* F. Muell.) whilst on the open plains and occasionally on sandier

Fig. 1. Dr Ludwig Leichhardt.

soils box and the poplar gum (*E. platyphylla* F. Muell.). Moreton Bay ash (*E. tessellaris* F. Muell.) was found on the flats, and on sandy soils the stringy-bark (*E. tetrodonta* F. Muell.). The silver-leafed ironbark (*E. shirleyi* Maiden) occurred on the ridges. Once he was north of where Mount Surprise is today, two new eucalypts appeared which caught his eye, these were *E. miniata* Cunn. ex Schauer 'a eucalyptus, with very scanty foliage, orange-coloured blossoms, seed-vessels longitudinally ribbed and as large as the egg of a fowl; its butt was covered with a lamellar bark, but the upper part and branches were quite smooth' and *E. confertiflora* F. Muell. 'another eucalyptus, with a scaly butt like the Moreton Bay ash, but with smooth upper trunk and cordate ovate leaves, which was also new to me, we called it the Apple-gum.'(22 May).

On 22 May they discovered a westerly flowing river which he called the Lynd. They then followed this river as it cut its way through mountainous country, sometimes basaltic, sometimes granitic. As they moved northward the vegetation changed and Leichhardt commented on the many new trees and shrubs which they encountered. Whenever small river flats occurred boxes were common, fringing the channels were large drooping teatrees (*Melaleuca argentea* W. Fitzg.), casuarina (*C. cunninghamiana* Miq.), sarcocephalus [*Nauclea orientalis* (L.) L.], flooded gum (*Eucalyptus camaldulensis* Dehnh.) and a terminalia (*Terminalia platyphylla* F. Muell.) 'with spreading branches and broad elliptical leaves' (27 May). Several other species, often with edible fruit as well as gum, occurred throughout the area. These were probably *T. aridicola* Domin, *T. platyptera* F. Muell. and *T. subacroptera* Domin. Leichhardt tried most fruits that he came across e.g. the 'fleshy fruit of the Severn tree [*Petalostigma banksii* and/or *P. pubescens* Domin] had an exceedingly bitter taste which was also imparted to the flesh of the emu' (19 July). However not all fruits were as bad as can be seen by his description of the 'Bread tree of the Lynd' (*Gardenia edulis* F. Muell.). 'There was another small tree, the branches of which were thickly covered with bright green leaves; it had round inferior fruit, about half an inch in diameter, which was full of seeds: when ripe, it was slightly pulpy and acidulous, and reminded me of the taste of the coarse German rye bread . . . I ate handfuls of the fruit without the slightest inconvenience' (31 May). On the other hand the fruits of the nonda (*Parinari nonda* F. Muell. ex Benth.) whose 'pericarp is very mealy and agreeable to eat and would be wholesome, if it was not so extraordinarily binding' (3 July).

Gradually the box flats became more frequent although rocky ranges still had to be crossed, but by the beginning of June the country was becoming a more open forest with ironbark (*Eucalyptus crebra*) and lanceolate box (? *E. leptophleba* F. Muell.) as the dominants. Around some of the lagoons which were now more frequent, he found 'an elegant Acacia about thirty or thirty-five feet high, grew on its small flats: it had large drooping glaucous bipinnate leaves, long broad pods and oval seeds, half black and half bright red', (*Adenanthera abrosperma* F. Muell.) (2 June). Silver-leafed ironbark (*Eucalyptus shirleyi*) was common on the ridges.

Between 5 June and 15 June they travelled chiefly over river flats or undulating open forested country. Where the sandstone or granite ridges encroached on the river then they travelled along its bed. Channels along the river were covered by a myrtle [probably *Melaleuca argentea* or *M. nervosa* (Lindley) Cheel or a form of it], while the box dominated the river flats although some apple gum and Moreton bay Ash (*Eucalyptus confertiflora* and *E. tessellaris*) were also present. The narrow-leafed ironbark (*E. crebra*) was more frequent on the ridges.

On 16 June they finally turned westward near the junction of the Lynd and the Mitchell and camped at what is now known as Highbury lagoon — he wouldn't recognize it now as rubber vine [*Cryptostegia grandiflora* (Roxb.) R. Br.] has taken over! As he noted, some *Nymphaea gigantea* Hook. and *Nymphoides* Seguier sp. were present. He encountered fine specimens of 'bloodwood, stringybark and box' (16 June). In 1985 the dominants were *Eucalyptus microneura* Maiden & Blakely, *E. polycarpa* F. Muell. and *E. tetrodonta* along the river, whilst *E. dichromophloia* F. Muell. and *E. papuana* F. Muell. were the dominant eucalypts in the open forest away from the river. *Melaleuca viridiflora* Sol. ex Gaertner and *Petalostigma banksii* were common understory elements, as well, small thickets of *Carissa lanceolata* R. Br. often occurred. These gave way to flat grassy plains which 'were bounded by an open forest of the acacia of the Expedition Range', (? *Acacia holosericea* A. Cunn. ex G. Don) from which they collected good supplies of gum which they then ate. *Acacia holosericea* was a very common wattle, particularly along creeks or where moisture had collected. He noted groves of a bipinnate acacia with articulate pods and large brown seeds. A grove of wattles resembling *Acacia bidwillii* Benth. were present near the entrance to Highbury Station.

During most of the next week the party often travelled up to several miles away from the river in order to avoid the worst creeks and gullies, hence the country that they traversed was chiefly open forest interspersed with 'immense uninterrupted flats with very clayey soils' (19 June). Leichhardt commented on the regular angular-shaped cracks which occurred on these grassy plains and which after light falls of rain are

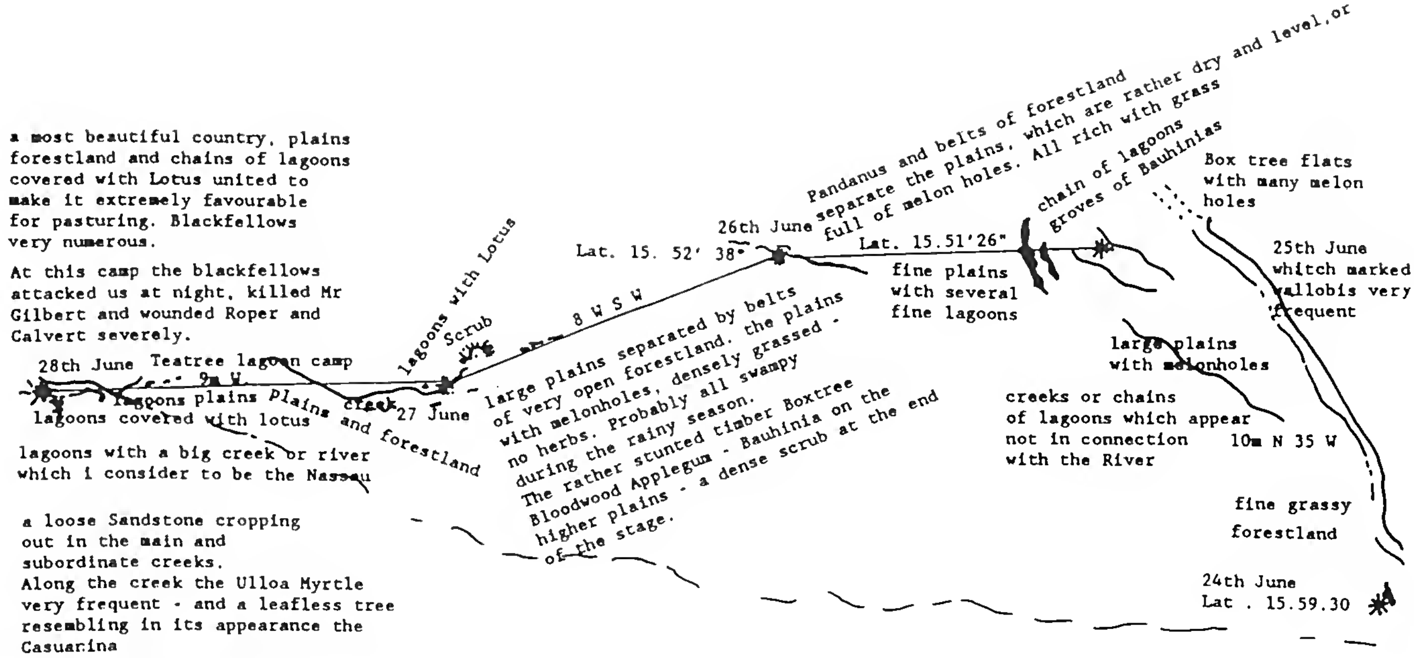

Fig. 2. Sketch map covering the route traversed by Leichhardt and party 24–28 June 1845. (Redrawn from field note books).

Fig. 3. The lagoon on 'Dunbar' Station, near the Nassau River beside which John Gilbert was buried.

fringed by young grass. Associated with these plains were many bauhinias [*Lysiphyllum cunninghamii* (Benth.) de Wit] 'covered with red blossoms' (20 June). *Eucalyptus confertiflora*, occasional *E. terminalis* F. Muell., *Terminalia* L. spp., *Dolichandrone heterophylla* (R. Br.) F. Muell., *Grevillea* R. Br. ex Salisb. spp., particularly *G. striata*, *Hakea* Schrader spp., *Melaleuca viridiflora*, *Petalostigma banksii*, *Excoecaria parviflora* Muell. Arg., and *Cochlospermum gillivrai* are common today. Around the lagoons, which were common in the area, was grewia (*Grewia retusifolia* Kurz) whose fruits when boiled produced a 'beverage which. . .was at all events the best we had tasted on our expedition' (19 June), *Melaleuca* spp., *Nauclea orientalis*, *Barringtonia acutangula* (L.) Gaertner which he termed the myrtle mangrove, and *Pandanus spiralis* R. Br. As well lotus (*Nymphaea gigantea*) was very common in all the lagoons whenever water was present. When they reached what is now known as Mosquito Lagoon on 21 June they surprised some

natives who left behind a net full of *Nymphaea* L. seeds, which Leichhardt's party then took with them.

The diversity of trees and shrubs on the banks of the Mitchell increased as they moved westward, particularly as the flood plain widened after the junction with the Palmer. A lot of the area appeared to be seasonally inundated. Corypha (*Corypha utan* Lam.) now became common, as did the cluster fig (*Ficus racemosa* L.).

On 25 June, (Fig. 2) Leichhardt decided to turn westward and so leave the Mitchell. As he had passed the latitude of the Nassau by going west he should reach the coast and be able to travel around the Gulf. He now entered quite different country which was difficult to traverse because of the numerous watercourses running virtually parallel to one another, the numerous small lagoons and patches of scrub which were difficult to penetrate with the cattle. Leichhardt described the area traversed: 'we past some very fine and long water-holes with reeds or covered with the white species of *Nymphaea*. Groves of *Pandanus spiralis* were growing along the banks. Fine grass full of melon holes but well grassed were separated from each other by belts of forest land' (26 June).

The description by Gilbert (1845) probably indicated the feelings of the rest of the party a little better, 'at first through a very thick forest of small timber [*Melaleuca acacioides* and *M. foliolosa* often form dense thickets in this area] for a mile leaving the thick brush on our right, then we again came upon thinly wooded country for 2 miles, then upon a long narrow lagoon, which took us nearly a mile to get to the end of it, when we came upon a second, upon getting clear from this we had about 2 miles of a plain to cross, the last mile through an open forest and we camped at a miserably small water-hole in a shallow creek.' *Eucalyptus chlorophylla* Brooker & Done, *E. microtheca* F. Muell. and to a lesser extent, *E.* aff. *papuana*, *E. confertiflora* and *E. terminalis* were the main eucalypts encountered in this area. *Terminalia platyptera*, *Lysiphyllum cunninghamii*, *Pandanus spiralis* and *Grevillea striata* were also quite common in the open forested areas.

This was the pattern till 28 June when after crossing many gullies they finally crossed the main branch of the Nassau. Here Leichhardt recorded for the first time finding 'a small myrtle tree with smooth bark' (*Melaleuca symphiocarpa* F. Muell.), also described on his sketch map (Fig. 2) as the Ulloa Myrtle, and 'a leafless tree of the appearance of Casuarina' (*Calycopeplus casuarinoides* L. S. Smith). They then came to a chain of shallow lagoons many of which were dry, but they camped near one 'surrounded by a belt of small teatrees with stiff broad lanceolate leaves' (28 June).

That evening, shortly after 7 pm, spears were thrown into the camp. Gilbert died instantly. Roper and Calvert were severely wounded. Dalton's (1988) reconstruction of the events of that evening suggests that this was a punishment spearing. The spears used were barbed, a style used today (J. C. Taylor, pers. comm.) by the Mitchell River aborigines solely for punishment. They are meant to wound, targeting particularly the thighs and buttocks. They are not meant to kill. It appears that Gilbert collected a single spear in the neck as he stooped to come out of his tent. Although he does briefly consider other possibilities Dalton (1988) feels

Fig. 4. Marker erected at the site of the grave.

that this was a retaliatory raid related to the removal, on 21 June, of the lotus seeds at Mosquito Lagoon. This was done without prior consent from their owners. He further suggests that the numerous fires observed in the close vicinity of the party over the preceding days were warning fires made after an attempt had been made by the aborigines to hold a discussion with the party. They had been rebuffed by Leichhardt discharging a gun.

Gilbert was interred on 29 June and a large fire built over the grave 'for preventing the natives from detecting and disinterring the body'(29 June). Many lagoons in the area have since been labelled Gilbert's lagoon. The clue to which lagoon was given by the last entry in Gilbert's (1845) diary: 'we crossed a considerable creek, or as the doctor thinks the Nassau running to the westward from this the remaining part of the stage was through a beautiful open country thickly studded with lotus ponds at one of which we camped. Native fires in every direction and very near us, but none of the natives seen, about a mile to our right appeared the dark line of a scrub, most probably edging the creek we crossed.' If Leichhardt's distances and readings are relatively accurate and are correlated with the descriptions of the countryside traversed then only one lagoon (Fig. 3), fits this description given by Gilbert. Several attempts were made to locate the grave prior to success in October 1985. Using a caesium magnetometer which he had developed, Dr J. Stanley (University of New England) covered the area on a grid pattern and eventually located an area where an intense fire had been lit. This instrument allows very small changes in

the earth's magnetic field, such as occurs after clay is baked, to be detected. The area indicated was then partially excavated so as to remove the top soil deposited in the past 140 years until a baked clay layer, such as would be expected after an intense fire, was found. The outline of the area was in keeping with a large man made fire which was kept burning for several days. A marker was constructed by the members of 2/4 RAR and erected at the site (Fig. 4).

Trees and shrubs currently adjacent, or in close proximity, to this lagoon are; *Eucalyptus confertiflora*, *E. microtheca*, *Melaleuca viridiflora* (2 variants), *M. stenostachya* S. T. Blake, *Barringtonia acutangula*, *Grevillea striata*, *G. parallela*, *Carissa lanceolata*, *Excoecaria parvifolia* and *Erythrophloem chlorostachys* (F. Muell.) Baill.

On 1 July, the party left the lagoon having allowed Calvert and Roper to recover slightly from their wounds. Leichhardt now changed his routine and whenever possible covered 10–14 miles per day, travelling all day if necessary. They crossed extensive box flats alternating with undulating country, numerous shallow lagoons and watercourses. He continued to sample fruit and tried out ashes with which to treat the wounds. He noted that the rawsberry jam tree [*Cathormium umbellatum* (Vahl) Kosterm.] produced a particularly good lye for dressing wounds. On 12 July 'we crossed a small river with a course W by N, it had a broad sandy bed, numerous pools of water and steep banks covered with drooping teatrees and sarcocephalus (*Melaleuca argentea* and *Nauclea orientalis*), I called it the 'Gilbert'. Port Essington was ultimately reached on 17 December 1845, nearly 16 months after departing from the Darling Downs. Roper and Calvert both appeared to make a complete physical recovery.

Having in effect travelled with Leichhardt for over a month, I have considerable respect, as does Professor Brian Dalton, for his powers of observation and description, although he was well trained in science. The directions given and distances noted on his sketch maps showed remarkable accuracy, considering his traverses were not straight lines; daily distances travelled were an educated estimate. He had no opportunity to reset his chronometer, and his navigational instruments had every opportunity to sustain damage in saddle bags and expedition cases. I was slightly surprised that several trees which were quite common were not mentioned although he had referred to them much earlier, e.g. *Lophostemon grandiflorus* (Benth.) Peter Wilson & Waterhouse and *Planchonia careya* (F. Muell.) Knuth. He also seems to have had some problems with his narrow-leafed grevilleas!

Considering that they traversed a lot of country completely unchartered as far as Europeans were concerned, is it surprising that considerable reconnoitring was required? Leichhardt needed to be firm to get through the inhospitable country and his only empathy appeared to be with Gilbert, yet he was not without some compassion. He frequently stopped to rest the foot-sore animals in the first six months and then after Gilbert's death, although he may at times have appeared heartless, he did stop and allow the wounded to rest and recuperate whenever he felt it was safe for the party to do so. Current survival tactics in the Army are to consider the group as a whole rather than the individual (L. J. Hiddens, pers. comm.) Lack of preparation for waterless tracts seems to me to have been his main defect as an explorer. But how do you manage when you are also driving stock, you can't carry sufficient water for them too?

Note

1. All subsequent quotes, unless otherwise indicated, refer to this journal. The date is placed in parenthesis.

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Hugo Flecker and the North Queensland Naturalists' Club

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Abstract

The foundation and growth of the North Queensland Naturalists' Club and the establishment and growth of the Club's herbarium (CAIRNS) is examined. The role played by Dr Hugo Flecker, the foundation president of the Club and curator of the collection for over 25 years, is discussed and a condensed biography of his life given. Flecker's ties with taxonomic botanists in major Australian and overseas herbaria are outlined. Though primarily a collection of North Queensland plants, the CAIRNS herbarium received material on exchange or as gifts from many Australian and overseas sources. Various estimates of the size of the collection have been made but it would appear to be upwards of 10,680 gatherings. The types of 29 names have been located to date. The status of these is indicated and a list of type material collected by Flecker is given. In 1971 the collection was donated to the CSIRO Division of Forest Research at Atherton (QRS).

In August 1971, the substantial plant collection of the North Queensland Naturalists' Club was donated to the CSIRO herbarium at Atherton (QRS). At that time, the Flecker collection, as the Naturalists' Club herbarium was known, was a significant addition to the newly established QRS collection. The importance of the Flecker collection is not widely appreciated. This paper traces the history of the collection and discusses the role of Dr Hugo Flecker in the formation of the North Queensland Naturalists' Club and in the foundation and growth of its plant collection.

Biographical information

Several short biographies of Hugo Flecker have been published (Lester 1957; McDonald 1957; Stokes 1981) and a detailed review of his life and work is currently being prepared (Clarkson, in prep.).

Hugo Flecker (Fig. 1) was born in the Melbourne suburb of Prahran on the 7 December 1884. His early life was spent at Henley Beach in South Australia where his parents were hotel keepers. He received his early education at the Prince Alfred College in Adelaide before commencing medical studies at Adelaide University. Industrial problems in the teaching hospitals in South Australia interrupted his studies and his course was completed at Sydney University, from which he graduated M.B., Ch.M. in 1908. Following this, Flecker worked at various hospitals in Sydney before undertaking post graduate studies in Edinburgh which led to his admission as a Fellow of the Royal College of Surgeons (Edinburgh) in 1912. Two years were spent working in Canada before he returned to Australia shortly before the outbreak of the First World War. Enlisting with the 1st Australian Imperial Force at Sydney on 20 August 1914, Flecker served with the rank of Captain, and later Major, with the Royal Army Medical Corps at various casualty clearing stations and field hospitals in Egypt and western Europe. In September 1916, while based at Wimeraux in France, he was hospitalised suffering from dermatitis. This failed to respond to treatment and eventually resulted in his being invalided home and demobilized in April 1917. The doctor was plagued by this skin condition for the rest of his life and it may have led to his post war specialisation in radiology. In this field he was not required to scrub up with the irritating carbolic soaps as regularly as he would have had he persevered in surgery. In the then fledgling speciality of radiology, Flecker was regarded highly by his peers. He pioneered the use of therapeutic radiotherapy in Australia for the treatment of malignant disease (Flecker 1923) and he was responsible for several important radiological studies of skeletal development (Flecker 1942).

A combination of factors led Flecker to quit Melbourne and move to Cairns in Far North Queensland. The depression years were hard on Flecker and his family. He had married Thelma Arnold within a few days of returning from his overseas military service and by 1932 he had two children, a daughter Alice, then aged 14, and a son Pat, who was 12. Even though well established in his medical practice, patients often left medical bills unpaid and the family found it difficult to survive financially. A respiratory allergy, from which Flecker suffered and which led to bouts of hay fever, was aggravated by seasonal conditions in Victoria. Finally, Flecker's life long interest in natural history may have been the catalyst. An x-ray technician who had worked with Flecker in Melbourne was a North Queenslander by the name of Bruce Cummings. Flecker and Cummings had developed a strong friendship, no doubt sparked by their mutual interest in natural history. The pair often discussed the largely unexplored wonders which abounded in tropical Queensland (B. Cummings, pers. comm.). Cummings had returned to the North and was living in Cairns when Flecker decided to move there in 1932. The decision to leave Melbourne could not have been an easy one. It meant leaving his wife to care for the family home in St Kilda for the depressed economy precluded

Fig. 1. Dr Hugo Flecker, taken prior to 1951, when in his mid-sixties.

its sale. It also meant leaving a major city with a well established medical infrastructure for a provincial town which provided little in the way of sophisticated medicine. As things turned out, the family separation proved to be much longer than had probably been anticipated. By the time the Melbourne property could have been sold, the Second World War had broken out and life was considered far safer in Victoria because of the ever present threat of a Japanese invasion in the Far North. It was 1948 before Hugo and Thelma were united in Cairns.

Flecker's interest in natural history was life long. As a boy, he belonged to a group known as the Boy's Field Club and had collected sea shells extensively along the South Australian coastline. While at university, he was a member of the Naturalists' Club of New South Wales and the Sydney University Students' Science Club. After the war years he joined the Field Naturalists' Club of Victoria. On arriving in North Queensland and finding no organisation to co-ordinate the activities of the amateur naturalists in the area, Flecker prompted the Mayor of Cairns, Alderman W. A. Collins, to chair a public meeting to consider the formation of such a club. The outcome of the meeting, held on 19 August 1932, was the establishment of the North Queensland Naturalists' Club with Hugo elected foundation president. From then until his death in 1957, the activities of Flecker the medical practitioner and Flecker the naturalist were intimately interwoven with the activities of the Naturalists' Club. In those 25 years, Flecker served as president for 16 years, 14 of these consecutively (1932–1946), was vice-president from 1948 until his death and patron from 1947.

The close assocation of natural history and medicine led to a series of papers on human deaths and and injuries produced by plants and animals (Appendix I). Probably the best known of these are those on jellyfish stings. His work in this field was acknowledged by R. V. Southcott of South Australia who named the organism responsible for numerous fatal stings in tropical Australian waters, *Chironex fleckeri* (Southcott 1956). Following a resolution of a medical congress held in Cairns in 1935, Flecker maintained a registry of injuries caused by plants and animals. This register, containing case histories and associated investigations, disappeared about the time of Flecker's death (Barnes 1964) and has not been rediscovered.

Hugo died in Calvary Hospital in Cairns on 25 June 1957 after a short illness. He was survived by his wife and two children. Even following his death, recognition of his contribution to medicine, natural history and civic life continued. In 1957, the Royal Geographical Society (Queensland Branch) awarded him the Thompson Foundation Memorial Medal, its highest distinction. The medal is inscribed 'Awarded posthumously to Dr Hugo Flecker for outstanding service to Geographical Science'. In 1971, the Cairns City council named its botanic gardens at Edge Hill the 'Flecker Botanic Gardens'. A street in the same suburb bears his name and a medical centre, which houses many of the consultant medical specialists in Cairns, was named 'Flecker House' when it opened in 1983. He is commemorated in the names of six plants and two animals (Appendix I).

The North Queensland Naturalists' Club

In October 1932, under Flecker's direction and guidance, the Naturalists' Club began the production of its journal and magazine, *The North Queensland Naturalist*. Initially a chatty monthly newsletter, this soon developed into an eight page quarterly publication which included a great deal of information of interest to professional biologists, including systematic botanists. This standard was maintained for a number of years after Flecker's death but with waning interest in the Club, the journal, though still produced, has virtually reverted to the newsletter format. Between 1935 and 1964 but particularly prior to 1957, quite a number of new taxa were described and new combinations made in the journal. These are listed in Appendix III. The orchid taxonomists, H. M. R. Rupp, T. E. Hunt, S. F. St. Cloud, W. H. Nicholls and A. W. Dockrill, in particular, published a number of new taxa in *The North Queensland Naturalist*. Most of the plants described had been discovered through the efforts of Club members.

From May 1933 until December 1948, Flecker published a census of North Queensland plants as a supplement to the Club journal (Flecker 1950a). Initially it was little more than a compilation of data from F. M. Bailey's (1899–1902) *The Queensland Flora* but, as the knowledge of Queensland's tropical flora was extended, addenda and corrigenda were produced. The list was never published as a single volume but the portions dealing with orchids and ferns were issued separately in 1945 and 1946 respectively as saleable publications. The orchid list was revised by A. W. Dockrill in 1966 (Dockrill 1966). A list of edible plants in North Queensland compiled by Flecker and pub-

lished serially in *The North Queensland Naturalist* between March 1944 and September 1947 was collated and issued separately by the Club in 1948 (Flecker *et al.* 1948).

In February 1935 Flecker began a column in a Cairns weekly newspaper headed 'Current Nature Topics'. This column must have proved popular with readers for it ran continuously, through more than 1,036 issues, until Flecker's death. Topics discussed in the column ranged widely from the activities of the Naturalists' Club to new or interesting discoveries and the comings and goings of scientists to the Far North. Through the column, Flecker attempted to raise the readers' awareness of environmental issues such as the problems associated with uncontrolled fires on the hillsides around Cairns, the threat posed by the introduction of exotic animals such as the cane toad and gambusia (mosquito fish), and the impact of large numbers of tourists visiting potentially fragile areas such as Green Island and Michaelmas Cay. The consequences of soil erosion, the spread of introduced weeds such as lantana and the shooting of kangaroos were also discussed. Flecker fequently mentioned the need for a museum and a botanic garden in Cairns, as well as the desirability of using native plants in cultivation rather than exotics. The range of topics discussed show that Flecker was many years ahead of his time. Issues he attemped to draw to people's attention in the 1930s and 40s have become major topics of concern for the conservation lobby of the 1970s and 80s.

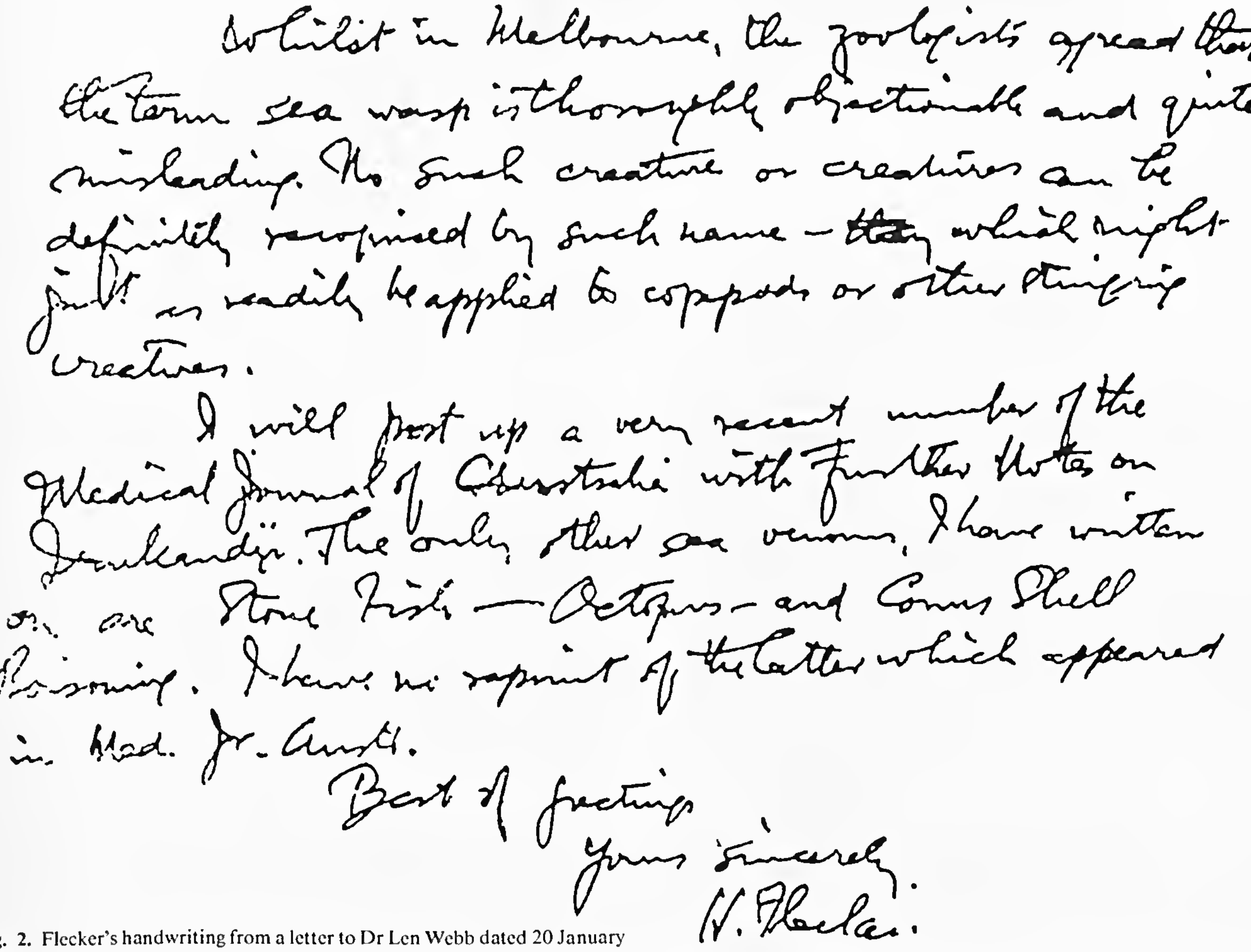
A herbarium for Cairns

In a letter dated 2 October 1933, Cyril White, the Queensland Government Botanist, wrote to Flecker:

> Personally I think if the North Queensland Naturalists' Club wants to do good work with the flora the best way, perhaps, would be to form a local herbarium, and to collect plants assiduously on your various rambles, sending specimens to me for identification and report. In this way, working in the rich flora of North Queensland, you cannot fail to make extensive additions to the knowledge of our flora, because the flora of North Queensland is far from being completely known.

Flecker took up this suggestion with some vigour and the North Queensland Naturalists' Club herbarium was begun. The growth of the collection can be traced by reference to the weekly newspaper column. From time to time Flecker would include a short article on the herbarium noting how many specimens it held, where material had been coming from and generally conveying the message to readers that a herbarium in Far North Queensland was a very useful thing to have.

In April 1937 there is reference to 1,603 specimens (? species), by January 1940 this had grown to 3,011 and by March 1950 the collection stood at 5,014. Various estimates of the final size of the collection have been seen. The most accurate is probably that made by CSIRO staff at Atherton as they processed the collection for incorporation at QRS after it was donated to them in 1971. A total of 10,680 gatherings were


Whilst in Melbourne, the zoologists agreed that the term sea wasp is thoroughly objectionable and quite misleading. No such creature or creatures can be definitely recognised by such name — ~~they~~ which might just as readily be applied to copepods or other stinging creatures.

I will post up a very recent number of the Medical Journal of Australia with further Notes on Irukandji. The only other sea venoms I have written on are Stone Fish — Octopus — and Conus Shell Poisoning. I have no reprint of the latter which appeared in Med. Jr. Austl.

Best of greetings

Yours sincerely

H. Flecker.

Fig. 2. Flecker's handwriting from a letter to Dr Len Webb dated 20 January 1957.

Fig. 3. Sheet from the North Queensland Naturalists' Club herbarium as incorporated in QRS, showing a typical label and paper tag with accession number. The stamp in the lower right hand corner readily identifies material from the Flecker collection at QRS.

received by QRS. These included 9,923 angiosperms, 72 gymnosperms, 468 brophytes and 217 marine algae and fungi. Originally material was collected by Flecker and other local Club members but eventually enthusiasts from further afield and members of the public began sending material for identification. Most of these found their way into the collection. A few of the more notable collectors were A. de Lestang who sent specimens from Adel's Grove near what is now Lawn Hill National Park, K. A. MacPherson who collected in the Mackay-Proserpine area, and Miss E. Henry and Mrs Sparvell who were responsbile for many new or interesting mosses. Flecker also exchanged duplicates with collectors within Australia and overseas.

Initially, as White had suggested, collections were sent to the Queensland Herbarium (BRI). Usually duplicates were sent with the first specimen being retained for the Cairns collection but occasionally, it seems, there were no duplicates and Flecker would request the return of the material. As Flecker and his work became more widely known and contacts were developed with botanists elsewhere, material was referred to specialists in several major herbaria. In this way, mosses from North Queensland found their way to H. N. Dixon, one of the leading bryologists of the day, and orchids were sent to H. M. R. Rupp and W. H. Nicholls. It has also been suggested (J. Tracey, pers. comm.) that, as material from Flecker was often somewhat scrappy, staff at BRI did not particularly look forward to dealing with the often large collections sent down for identification and often chided him for the poor quality of the material. No documentary evidence to this effect has been located at BRI but Jim Willis (pers. comm.), former Assistant Goverment Botanist at the National Herbarium of Victoria (MEL), reports receiving 'copious scraps of botanical material' from Flecker in the 1940s 'for the simple reason that Brisbane declined to deal with them'. He also states that 'Melbourne got to dread the arrival of Flecker specimens and, so not to offend such a nice

chap, finally pleaded increasing pressure of work as an excuse to avoid wasting time on the identification of these fragmentary and hopeless bits of material'. To be fair to Flecker, it should be realised that not all of the material he was sending for identification was collected by himself. Quite a lot of material was passed on from others.

As White had expected, extensive additions to the knowledge of the flora were made by Flecker and his associates. With the description of new taxa, the herbarium began to accumulate type material. A search of the collections has so far yielded 24 type specimens (29 names). In most instances these are isotypes, however, the holotypes of five orchid names attributed to S. F. St. Cloud have been located. A full list of types and authorities for the names is given in Appendix IV. As far as has been ascertained, Flecker himself was responsible for the collection of 25 gatherings nominated as types (Appendix V). Fifteen of these are angiosperms while the remaining ten are mosses. Not all of these have been located amongst the Flecker material at QRS.

The North Queensland Naturalists' Club herbarium was listed in the second edition of the International Association for Plant Taxonomy's *Index herbariorum* (Lanjouw and Stafleu 1954). Flecker chose the acronym CAIRNS. It has appeared in each edition since with the entry in the current seventh edition (Holmgren *et al.* 1981) noting the incorporation in QRS.

Some care should be taken in the citation of specimens from the Flecker collection. The label usually bears a number, most often typed at the top centre. A small paper tag bearing the same number is often attached to the specimen. Several workers, for example Dixon (1941), Fosberg (1938) and Munir (1984), have attributed this number to the collector. Most likely this is a herbarium accession number. It appears that a master register was kept and that the number was assigned as each specimen was processed. However, there was no such register amongst the Flecker material when it arrived at QRS and recent attempts to discover its whereabouts have been unsuccessful. Three typed sheets found with material sent by Flecker to MEL for identification support this master register theory. Part of the list reads:

11929. Lake Barrine, Mrs S. E. Stephens, November, 1947.
11977. Cultivated at Thursday Island, H. Flecker, 19.12.47.
12042. Growing on *Pyrrhosia rupestris*, Murrurundi, New South Wales, altitude 1200 feet, Dr B. J. Middleton, posted 10.1.48.
12100. Growing on log, Miller's Beach, H. Flecker, 18.1.48.
12111. Growing amongst sedges, Prior Creek, R. Le Rossignol, 26.1.48.
12142. Studley Park, Victoria, H. T. Clifford, 15.6.47.
12143. Mareeba, H. Flecker, 28.10.47.

This shows material collected by five different individuals. Each collection is assigned a number in an ascending sequence with material collected in 1948 numbered ahead of some collected in 1947. To avoid confusion or ambiguity it is suggested that material from the North Queensland Naturalists' Club herbarium be cited as CAIRNS #### or North Queensland Naturalists' Club Herbarium No. ####.

One of Flecker's special interests in the 25 years he spent in Cairns was to see the establishment of a museum which would incorporate the Naturalist's Club herbarium (Flecker 1950b). His active lobbying obtained temporary accommodation for the collection but unfortunately he did not live to see a permanent location secured. Initially the herbarium was housed in a storeroom supplied and erected by the Cairns City Council at its nursery at Edge Hill. In 1949 the collection was moved to Kuranda Barracks, temporary war time buildings erected by the Royal Australian Navy on reclaimed land on the Cairns Esplanade. It remained there for 18 years until redevelopment of the site lead to the demolition of the buildings in 1967. Then, by arrangement with the Cairns City Council, the collection was returned to the original building at Edge Hill.

After Flecker's death, the collection was curated on and off by various Club members including Leonard J. Brass. Brass, well known for his outstanding work on the Archbold expeditions to Papua New Guinea and Cape York Peninsula, retired to Cairns in 1967 and acted as honorary curator until failing health forced him to relinquish the postion in 1971 (Stokes 1982). In that same year, with no one to replace Brass, the Club wrote to the Forestry and Timber Bureau (letter from Marion Cassels, secretary of the North Queensland Naturalists' Club):

> After much discussion with our Committee and having written to all members of the Club giving them the details of our proposal, we would like to offer to you, the Forestry Research Institute, the Flecker Herbarium which is in the Club's possession. Now that our Curator, Dr. Leonard J. Brass, is unable to look after this Herbarium, it is in danger of being neglected as there is no one in the Club able to take his place. Rather than see this vauable collection deteriorate and be wasted, we would like it to come to you where we know it will be properly housed, curated and used and it will be still in North Queensland, a point that the late Dr. Flecker was very keen about. At the moment the Herbarium is housed at the Botanical Gardens in Cairns.

The Flecker collection is now fully incorporated in the general collection at QRS. Specimens were remounted on the standard herbarium sheets in use there but, as each sheet bears a stamp on the lower right hand corner acknowledging the gift, the material is readily identified (Fig. 3). Since there is no cryptogamic collection at QRS, in November 1981 the bryophytes were passed on to Herbarium Australiense, now the Australian National Herbarium (CANB).

In a roundabout way Flecker's dream had become a reality. The Naturalists' Club had been unable to establish a permanent home for the collection from their own resources but they had ensured it would be properly housed and curated and that it would remain in North Queensland.

Acknowledgements

I extend my thanks to the following people who have provided assistance in various ways. Dr Bernie Hyland of CSIRO Atherton has at all times provided free and ready access to the facilities at QRS. Mrs Dawn Magarry, the secretary of the North Queensland Naturalists' Club, allowed me to copy a full set of Flecker's weekly press column, 'Current Nature Topics' and helped me to acquire a complete set of

the Club's journal, *The North Queensland Naturalist*. Dr George Scott of Queens College, University of Melbourne, answered many queries regarding Flecker's bryophyte collection. Mr Ken Cotterill, the librarian with the Department of Primary Industries, Mareeba, obtained much of the literature required and read and commented on the manuscript. Mr Hans Dillewaard of the Queensland Herbarium, Indooroopilly, assisted with the photographic work. The Central Army Records Office in Melbourne allowed me access to Flecker's record of military service. Finally, I extend my deepest appreciation to Mrs Alice O'Brien, Hugo Flecker's daughter, and his son Dr Pat Flecker of Townsville and Pat's wife Mary for their help in my research into their father's life. Their assistance has been invaluable.

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Appendix I

Published works by Hugo Flecker dealing with human deaths and injuries produced by plants and animals: all published in *Med. J. Australia*

Flecker, H. (1936). Cone shell mollusc poisoning, with a report of a fatal case. April 4: 464–466.

Flecker, H. (1937). Injuries caused by Australian scorpions. June 5: 875–876.

Flecker, H. (1940). Snake bite in practice. July 6: 8–13.

Flecker, H. & McSweeny, A. (1944). Irritation produced by procession caterpillar (*Ochrogaster contraria*). August 5: 137–138.

Flecker, H. (1944). Sudden blindness after eating 'Finger Cherries' *Rhodomyrtus macrocarpa*. August 19: 183–185.

Flecker, H. (1944). More fatal cases of bites of the taipan (*Oxyuranus scutellatus*). October 7: 383–384.

Flecker, H. (1945). Injuries by unknown agents to bathers in North Queensland. January 27: 98.

Flecker, H. (1945). Injuries produced by plants in tropical Queensland. June 23: 636–637.

Flecker, H. (1945). Injuries by unknown agents to bathers in North Queensland. July 28: 128–129.

Reid, C. C. & Flecker, H. (1950). Snake bite by a taipan with recovery. January 21: 82–83.

Flecker, H. (1952). Fatal stings to North Queensland bathers. January 12: 35–38.

Flecker, H. (1952). Fatal stings to North Queensland bathers. March 29: 458.

Flecker, H. (1952). Irukandji sting to North Queensland bathers without production of weals but with severe general symptoms. July 19: 89–91.

Flecker, H. (1952). Bite from broad-headed snake *Hoplocephalus bungaroides* (Boie). March 15: 368–9.

Flecker, H. & Cotton, B.C. (1955). Fatal bite from octopus. August 27: 329–332.

Flecker, H. (1956). Injuries from stone fish. September 8: 371–372.

Flecker, H. (1957). Further notes on Irukandji stings. January 5: 9.

Appendix II

Eponymy

Plants

Acacia fleckeri Pedley, *Austrobaileya* 1(2): 211 (1978).

Cupaniopsis fleckeri S. Reynolds, *Austrobaileya* 2(1): 47–48 (1984).

Dendrobium fleckeri Rupp & C. White, *Queensland Naturalist* 10: 25–27 (1937).

Ixora biflora Fosberg var. *fleckeri* Fosberg, *J. Bot.* 76: 276–277 (1938).

Liparis fleckeri Nicholls, *North Queensland Naturalist* 6(53): 1–3 (1938).

Neostrearia fleckeri L.S. Smith, *Proc. Roy. Soc. Queensland* 69(4): 46–48 (1958).

References to two mosses *Campylopus fleckeri* and *Philonotis fleckeri* have been seen, both attributed to H. N. Dixon but, as no place of publication has yet been found (G. Scott, pers. comm.), they have been considered *nomina nuda*.

Animals

Chironex fleckeri R.V. Southcott, *Austral. J. Mar. Freshwater Res.* 7: 255–280 (1956).

Eustacus fleckeri (Watson), *Mem. Nat. Mus. Victoria* 13: 19 (1941).

Appendix III

New taxa described and new combinations made in *The North Queensland Naturalist*

New Taxa — plants	Volume & Date	
Hymenophyllaceae		
Mecodium contiguum D. A. Smith	80	Sept. 1946
Meliaceae		
Dysoxylum sericiflorum C. White	33	June 1935
Orchidaceae		
Acianthus sublestus Dockrill	110	Jan. 1955
Bulbophyllum macphersonii Rupp var. *spathulatum* Dockrill	117	Mar. 1957
B. wanjurum T. Hunt	82	Mar. 1947
B. wilkianum T. Hunt	82	Mar. 1947
Cadetia ruppii St. Cloud	110	Jan. 1955
Cleisostoma cornutum Rupp	39	Dec. 1935

C. orbiculare Rupp	19	Apr. 1934
Corybas abellianus Dockrill	112	Sept. 1955
Cymbidium leroyi St. Cloud	112	Sept. 1955
Dendrobium aurantiaco-purpureum Nicholls	68	Mar. 1942
D. baseyanum St. Cloud	110	Jan. 1955
D. beckleri F. Muell. var. *racemosum* Nicholls	45	June 1936
D. canaliculatum R. Br. var. *pallidum* Dockrill	115	May 1956
D. cancroides T. Hunt	83	June 1947
D. foederatum St. Cloud	111	May 1955
D. fusiforme F. Muell. forma *magnifica* Dockrill	114	Feb. 1956
D. giddinsii T. Hunt	87	June 1948
D. luteocilium Rupp	77	Dec. 1945
D. variable Nicholls	56	Dec.1938
D. vinicolor St. Cloud	116	Sept. 1956
D. wilkianum Rupp	67	Dec. 1941
Eria irukandjiana St. Cloud	111	May 1955
E. queenslandica T. Hunt	85	Dec. 1947
Gastrodia queenslandica Dockrill	136	Sept. 1964
Liparis bracteata T. Hunt	81	Dec. 1946
L. fleckeri Nicholls	53	Mar. 1938
Mobilabium Rupp, gen. nov.	78	Mar. 1946
M. hamatum Rupp	78	Mar. 1946
Oberonia attenuata Dockrill	126	Dec. 1960
Pterostylis carinata Dockrill	110	Jan. 1955
Saccolabium loaderanum Rupp	101	June 1952
S. subluteum Rupp	105	June 1953
Sarcochilus olivaceus Lindley var. *borealis* Nicholls	60	Dec. 1939
Taeniophyllum cymbiforme T. Hunt	82	Mar. 1947
T. flavum Dockrill	125	Mar. 1960
T. wilkianum T. Hunt	80	Sept. 1946

New Combinations — plants

Gleicheniaceae		
Sticherus falbellatus (R. Br.) Ching var. *compactus* (C. White & Goy) D. A. Smith	80	Sept. 1946
Orchidaceae		
Dendrobium lichenastrum (F. Muell.) Kanzlin var. *prenticei* (F. Muell.) Dockrill forma *aurantiaco-purpureum* (Nicholls) Dockrill	115	May 1956

New taxa — animals

Arachnida — Scorpionida		
Lychas lappa L. Glauert	109	Oct. 1954
Insecta — Hymenoptera		
Habrocytus garibaldia A. A. Girault	55	Sept. 1938
Inkaka A. A. Girault, *gen. nov.*	58	June 1939
I. 4-dentato A. A. Girault	58	June 1939
Insecta — Lepidoptera		
Candalides hyacinthia (Semper) var. *josephina* Harris	103	Dec. 1952
Pisces		
Dactylanthias mcmichaeli G. P. Whitley	131	June 1962
Scorpaena moultoni G. P. Whitley	127	Mar. 1961

Appendix IV

Type specimens located in the North Queensland Naturalists' Club herbarium

Austrobaileyaceae	
Austrobaileya maculata C. White	ISOTYPE
Caesalpiniaceae	
Cassia queenslandica C. White	ISOTYPE
Cunoniaceae	
Ceratopetalum corymbosum C. White	ISOTYPE
Hamamelidaceae	
Neostrearia fleckeri L. S. Smith	ISOTYPE
Myrtaceae	
Acmena macrocarpa C. White	ISOTYPE
Lindsayomyrtus brachyandrus (C. White) Hyland & Steenis	ISOTYPE
Xanthostemon brachyandrus C. White	ISOTYPE
Orchidaceae	
Bulbophyllum evasum Hunt & Rupp	ISOTYPE
Cadetia ruppii St. Cloud	HOLOTYPE
Cymbidium leroyi St. Cloud	HOLOTYPE
C. madidum var. *leroyi* (St. Cloud) Menninger	HOLOTYPE
Dendrobium foederatum St. Cloud	HOLOTYPE
D. vinicolor St. Cloud	HOLOTYPE
Eria irukandjiana St. Cloud	HOLOTYPE
Poaceae	
Lolium x *hubbardii* Jansen & Wachter ex B. Simon	ISOTYPE
Proteaceae	
Orites racemosa C. White	ISOTYPE
Sphalmium racemosum (C. White) Briggs, Hyland & Johnson	ISOTYPE
Rubiaceae	
Hodgkinsonia frutescens C. White	ISOSYNTYPE
Ixora orophila C. White	ISOTYPE
Rutaceae	
Zieria rimulosa C. White	ISOTYPE
Sapindaceae	
Alectryon tropicus (S. Reynolds) S. Reynolds	ISOTYPE
Atalaya rigida S. Reynolds	ISOTYPE
Cupaniopsis fleckeri S. Reynolds	ISOTYPE
Heterodendrum tropicum S. Reynolds	ISOTYPE
Solanaceae	
Solanum dimorphospinum C. White	ISOTYPE
Symplocaceae	
Symplocos ampulliformis C. White	ISOTYPE
S. cochinchinensis (Lour.) S. Moore subsp. *thwaitsii* (F. Muell.) Nooteb. var. *pilosiuscula* Nooteb.	ISOTYPE
S. cochinchinensis (Lour.) S. Moore subsp. *thwaitsii* (F. Muell.) Nooteb. var. *montana* (C. White) Nooteb.	ISOTYPE
S. stawellii F. Muell. var. *montana* C. White	ISOTYPE

Appendix V

Type material collected by Hugo Flecker

Angiosperms

Cunoniaceae
Ceratopetalum corymbosum C. White
Hamemelidaceae
Neostrearia fleckeri L. S. Smith
Loganiaceae
Gaertnera australiana C. White
Myrtaceae
Acmena macrocarpa C. White
Orchidaceae
Bulbophyllum evasum Hunt & Rupp
Cleisostoma cornutum Rupp
Liparis fleckeri Nicholls
Poaceae
Lolium x *hubbardii* Jansen & Wachter ex B. Simon
Rubiaceae
Hodgkinsonia frutescens C. White
Ixora biflora Fosberg var. fleckeri Fosberg
I. orophila C. White
Sapindaceae
Alectryon tropicus (S. Reynolds) S. Reynolds
Cupaniopsis fleckeri S. Reynolds
Diploglottis macrantha L. S. Smith ex S. Reynolds
Heterodendrum tropicum S. Reynolds
Symplocaceae
Symplocos cochinchinensis (Lour.) S. Moore subsp. *thwaitsii* (F. Muell.) Nooteb. var. *montana* (C. White) Nooteb.
S. stawellii F. Muell. var. *montana* C. White

Bryophytes

Brachytheciaceae
Rhynchostegium inaequale Dixon
Entodontaceae
Entodon terrae-reginae Dixon
Dicranaceae
Campylopus excurrens Dixon
Fissidentaceae
Fissidens patulifolius Dixon

Orthotrichaceae
Macromitrium funiforme Dixon
Pottiaceae
Barbula incerta Dixon, *nom. illeg.*, non Schum. 1803
Pterobryaceae
Callicostella rugiseta Dixon
Calyptothecium subecostatum Dixon
Endotrichella dietrichiae C. Muller var. *longiseta* Dixon
Rhizogoniaceae
Mesochaete grandiretis Dixon

Ronald Campbell Gunn (1808–1881)

A. M. Buchanan

Tasmanian Herbarium, G.P.O. Box 252c, Hobart, Tasmania, Australia 7001

Abstract

Ronald Campbell Gunn (1808–1881) was resident in Tasmania for the greater part of his life during which time he collected prolificly for the Hookers of Kew. A summary of his life is presented along with a chronological account of his collecting activities. Reference is made to other collectors who passed their material to Gunn for shipment to London.

In 1878 Ronald Gunn presented his valuable herbarium of Tasmanian plants to the Royal Society of Tasmania. For many years, this collection lay uncurated until it was removed to Sydney and much of it incorporated into the National Herbarium of New South Wales (NSW). The remainder was returned to Tasmania and now forms the greater part of the archival collections of the Tasmanian Herbarium, Hobart (HO). Some further Gunn material came to light in Tasmania in later years.

The curation of some of these specimens has been hindered by the difficulties encountered in interpreting the original label data, especially with regard to collector. While Gunn himself collected the great majority of the specimens, it is known that a significant number were passed on to him by contributing collectors, in particular, Joseph Milligan (Buchanan 1987, 1988a). The compilation of separate itineraries for Gunn and Milligan based on well-labelled suites of specimens has clarified many of the uncertainties that previously existed (Buchanan 1988b). Specimens wrongly attributed have been distinguished and in many cases the collector identified. More importantly, the whereabouts of some unknown localities given on specimen labels has been revealed. For example, the collecting localities 'Painters Plains', 'Streleski (sic) Range' and 'Detention Corner' do not appear on maps but can now be located by their position in the collecting sequence in the Surprise River-Calder Pass area. Similarly, collections from localities with ambiguous names which occur in more than one place on the map of Tasmania can be correctly located. Gunn's localities: Mt Direction, Mt Arthur and Western Plains are examples; topographic features bearing these names occur in both the north and south of Tasmania. Other obscure localities such as 'Catt.', 'Neck' and 'W. Mts.', the last two sometimes misinterpreted as Eaglehawk Neck and West Coast Range, have also been identified.

The data used to compile Gunn's itinerary (Table I) have been almost entirely extracted from specimen labels at HO and NSW. The remainder have been gleaned from available literature. No doubt a much more complete record could be assembled by a search of the Gunn Papers housed at the Mitchell Library, Sydney, and of the specimens at Kew (K) and the British Museum (BM). However, since it was Gunn who prepared the specimens and consigned them to K, almost all bear labels in his handwriting whether he collected them or not and therefore material from other collectors is attributed to him. On the other hand, the duplicates which Gunn retained in his own herbarium and which are now housed at HO and NSW, sometimes bear the original collectors' labels and may provide more accurate information. At least four such cases have already been revealed (Haegi, 1982; Short, 1986; Buchanan, 1987, 1988). It is for this reason that the basic framework of the itinerary (Table I) has been built on Gunn's duplicate material that has remained in Australia and that label information from specimens at K and BM should be inserted with caution.

A selection of specimens collected is given in Table I in the column headed 'comments/collections'. Vascular plant nomenclature follows Buchanan *et al.* (1989); basionyms are given for type collections.

His life

Ronald Campbell Gunn was born at The Cape, South Africa, on 4 April 1808 to Scottish parents. His father, William Gunn, was a lieutenant in the 72nd Highland Regiment and the whole family accompanied him on his postings from South Africa to Bourbon (Reunion) in 1809 and to the West Indies in 1814. Ronald's mother died during their time at Bourbon. The Gunn family returned to Scotland in 1816 where Ronald received his education with the intention of pursuing a military career as his father and a brother had done. In 1825, Ronald accompanied his father to the West Indies and held a civilian post in Antigua. Here he married Eliza Ireland, a Dublin girl, in 1826. Their two eldest children, Ronald and Frances, were born in the West Indies (Baulch 1961).

During this time, Ronald's eldest brother William had secured himself a government position in Tasmania and he encouraged Ronald to join him. In 1829, Ronald returned to England and shortly afterwards the young family set sail for Tasmania arriving in Hobart on 5 February 1830. Over the next three years he held the positions of Superintendent of a convict barracks in Hobart, Assistant Superintendent of Convicts in Launceston and Police Magistrate in Launceston (Baulch 1961).

Gunn's interest in botany gained its initial impetus from his friendship with Robert W. Lawrence, the son of W. E. Lawrence, an influential land holder in the Launceston area. During the late 1820s the eminent British botanist, William J. Hooker, had attempted to contact potential plant collectors in Tasmania and his requests for material eventually came to Lawrence's attention. In June 1832 however, Lawrence, by letter, introduced Gunn to William Hooker as his friend and co-collector. Unfortunately Lawrence died unexpectedly the following year. Thereafter Gunn embarked on a hobby that was to occupy much of his time and energy for the remainder of his life (Burns & Skemp 1961).

In August 1832, Gunn despatched his first consignment to Hooker, a collection of vascular plants, bryophytes and lichens from the valleys and mountains east of Launceston, especially Ben Nevis and Mt Arthur where he collected the type of *Drosera arcturi*. During the next three years Gunn took every opportunity for collecting, travelling on horseback and on foot to a wide range of habitats within reach of his Launceston home. He collected on the summits of the Western Tiers ('W. Mts' on his labels), on Ben Lomond, in the midlands and at George Town on the north coast. In a letter to Hooker in March 1835, he wrote 'Last Sunday I accomplished 76 miles on foot and horseback in 28 hours' (Burns & Skemp 1961).

Gunn made the acquaintance of Joseph Milligan, a fellow Scot and surgeon on the Van Diemen's Land Company's grazing blocks at the Surrey and Hampshire Hills, inland from Burnie. Milligan collected specimens from that area and forwarded them to Gunn for despatch to Hooker. About this time Gunn's wife returned to Ireland and died there in 1836 (Burns & Skemp 1961).

In 1835 Gunn acquired the services of an assigned servant, James Lee, with specialized skills in bird skinning and taxidermy (A.O.T. CON 18/21), but not in botany.

In mid 1836 Gunn was transferred to Circular Head (Stanley), on the northwest coast, as Police Magistrate, a situation that offered new and wider opportunities for plant collecting. Although August is the month of his official transfer, the first volume of his *The Circular Head Scientific Journal* is dated 21 June indicating that he was already living there at that time. Gunn spent two years at Circular Head during which time he made frequent collecting forays on horseback to nearby coasts, forests and heathlands. Farther afield he collected at Rocky Cape and Sisters Hills and made numerous trips to Woolnorth in the far northwest by the Van Diemen's Land Company's schooner. In February 1837, he joined Joseph Milligan and together they collected over a wide area from Black Bluff and Middlesex Plains in the east to Chilton in the west. Mrs Charlotte Smith, wife of a Circular Head storekeeper, sometimes accompanied Gunn on his local collecting trips and assisted him in drying specimens and caring for his children (Burns & Skemp 1961).

Gunn made several visits to Victoria (Gunn A.O.T. M.M.109, 1842b; Maiden 1909; Balaam 1965), at first in search of grazing land and later to botanize and visit friends. There is some confusion (Willis 1949) over his earliest visits and it is possible that his 1835 visit, mentioned only as a closing comment six years later (Gunn 1842b), in reality occurred in 1836. This possibility is supported by a manuscript account (A.O.T. M.M.109), attributed to Gunn, of the 1836 visit in which he claims his landing in Port Phillip to be his first visit to the south coast of New Holland.

During his time at Circular Head, Gunn travelled to Hobart for the arrival of Sir John and Lady Jane Franklin in early June 1837. As Lieutenant-Governor of Van Diemen's Land, Sir John was a strong supporter of the sciences and Lady Franklin took an active interest in the flora of the island. In January 1838, Gunn accompanied the Franklins on a short visit to Wybalenna on Flinders Island. His close association with Sir John and Lady Jane Franklin led to his moving to Hobart in October 1838 as Second Police Magistrate and a member of the Assignment Board. Early in 1840 he became Sir John's private secretary (Burns & Skemp 1961).

An expedition was planned that would take Lady Franklin, by sea, to Port Davey and Macquarie Harbour and which Gunn would accompany as botanist. Gunn himself was accompanied by his assistant and his servant. Unfortunately the vessel was weather-bound at Recherche Bay and although Gunn collected widely in that area, including the type of *Leptinella intricata* (= *Cotula reptans*), the main destination of the expedition was not reached. They returned to Hobart by Christmas 1838 after spending about two weeks in the Recherche Bay and Southport area (Mackaness 1947).

On 13 December 1839, the French exploring expedition under Dumont d'Urville arrived in Hobart. The botanist Jacques Hombron and other members of the crew remained in Hobart to recuperate from dysentery while their expedition made a six weeks detour to the Antarctic before departing Hobart on 25 February 1940 enroute to the Auckland Islands. During this time the Frenchmen made Gunn's acquaintance and the surgeon, Le Guillou, later sent him specimens from the Auckland Islands. Gunn forwarded these to Hooker (Godley 1965).

In December 1839, Gunn married Margaret Jamieson of 'Glen Leith' near New Norfolk. His many collections made in the Glen Leith-New Norfolk area at that time no doubt indicates the frequency of their visits to his wife's family.

The next notable event in Gunn's life was the arrival in Tasmania of William Hooker's son, Joseph D. Hooker, on the Antarctic Expedition of Captains Ross and Crozier in the ships *Erebus* and *Terror* in October 1840. Hooker was anxious to see as much of the flora of Tasmania as possible and Gunn arranged for an assistant to accompany him. He visited Port Arthur in the east and Marlborough in the upper Derwent valley. In Hobart he had the use of Gunn's library and herbarium and together they collected in localities close to town. On these excursions Hooker collected and saw first hand many of the plants that he later published in his *Flora Tasmaniae* (Hooker 1855–59).

In January 1841, Gunn travelled to Lake St Clair to make the first collections from this now popular national park area; among these was a syntype of *Persoonia gunnii*.

Early in 1841, at the age of 33, Gunn resigned his official positions in Hobart to manage the estates of the late W. E. Lawrence in the Launceston area. Two

Table I
The collecting itinerary of R. C. Gunn

Date	Locality	Comments/collections
27 Sept. 1831	Launceston	*Ranunculus sessiliflorus*
1832	Launceston, allotment	*Poranthera microphylla*
1832	Launceston, marsh	*Apium prostratum*
July-Aug. 1832	Black Hills	
July-Aug. 1832	Mt Arthur [east of Launceston]	*Drosera arcturi*
July-Aug. 1832	St Patricks River	*Leptostomum inclinans*
July-Aug. 1832	Ben Nevis	
1833	Brocks Swamp	Exact location not known
25 Jan. 1833	Launceston to near Westbury	
26 Jan. 1833	To Deloraine area	
27 Jan. 1833	Dunorlan (Capt. Moriarty's)	
28 Jan. 1833	To Mersey River, foot of Gog Range	*Anodopetalum biglandulosum*
29 Jan. 1833	To Meander area	(Gunn 1834)
30 Jan. 1833	Ascent of Western Tiers	
31 Jan. 1833	Falls of the Meander River	*Athrotaxis* spp.
1 Feb. 1833	Source of the Meander River	*Tetracarpaea tasmanica*
2 Sept. 1833	Formosa	Visited Lawrence at Formosa
12 Mar. 1834	Launceston to St Patricks River	
13 Mar. 1834	Mt Barrow	
Mar. 1834	Ben Nevis	
Apr. 1834	Ben Lomond	*Gaultheria lanceolata* TYPE
Mar. 1835	Visited Victoria [?]	(Gunn 1842b)
Mar. 1835	Deloraine	
Sept. 1835	George Town	
Nov. 1835	Campbell Town, Elizabeth River	
Nov. 1835	Hobart	
Nov. 1835	Mt Wellington	
21 Feb. 1836	George Town to Mersey River by boat	
22 Feb. 1836	To Circular Head by boat	
25 Feb. 1836	To Robbins Island by boat	
27 Feb. 1836	Off Cape Otway, Victoria	
29 Feb. 1836	Port Phillip	(A.O.T. M.M.109)
1 Mar. 1836	Depart Port Phillip	
2 Mar. 1836	Westernport	
June 1836	Circular Head	(Gunn, 1836 *et seq.*)
19 Aug. 1836	Circular Head	Transferred to Circular Head
1 Oct. 1836	Woolnorth	
16 Oct. 1836	Woolnorth	*Asperula conferta* var. *abbreviata* TYPE
25 Oct. 1836	Circular Head	*Euphrasia multicaulis* TYPE
Nov. 1836	Welcome River, Morhurst	(Lander 1988)
15 Nov. 1836	Circular Head	
15 Nov. 1836	Highfield, Circular Head	
16 Nov. 1836	Forest	
16 Nov. 1836	Circular Head	
24 Nov. 1836	Woolnorth	*Stackhousia flava* TYPE
24 Nov. 1836	Cape Grim	
25 Nov. 1836	Woolnorth	
10 Dec. 1836	Heathy Plain	
10 Dec. 1836	Circular Head	
11 Dec. 1836	Heathy Plain	
16 Dec. 1836	Rocky Cape	
16 Dec. 1836	Detention River	
17 Dec. 1836	Black River	
27 Dec. 1836	Circular Head	
27 Dec. 1836	Circular Head, neck	
2 Jan. 1837	Circular Head	
11 Jan. 1837	Circular Head	*Epilobium pallidiflorum* TYPE
11 Jan. 1837	Circular Head, neck	
29 Jan. 1837	Woolnorth	
1 Feb. 1837	Rocky Cape	
7 Feb. 1837	Emu River, Hampshire Hills	
8 Feb. 1837	Hampshire Hills	*Ranunculus lappaceus*, *Gonocarpus serpyllifolius* TYPES
Feb. 1837	Black Bluff	
14 Feb. 1837	Middlesex Plains	*Caldasia* (*Oreomyrrhis*) *argentea* TYPE — with Milligan
Feb. 1837	Mayday Plain	
Feb. 1837	Leven [River]	
15 Feb. 1837	Vale of Belvoir	Collecting with Milligan
16 Feb. 1837	Chilton	
16 Feb. 1837	Burghley, Surrey Hills	*Hovea purpurea* var. *montana* TYPE
21 Feb. 1837	Sisters Hills	
25 Feb. 1837	Circular Head	
27 Feb. 1837	Circular Head, neck	
27 Feb. 1837	James Sawyer Bay/Rocky Cape	
1 Mar. 1837	Rocky Cape	
1 Mar. 1837	James Sawyer Bay/Rocky Cape	
1 Mar. 1837	James Sawyer Bay/Circular Head	

Table I — *continued*

Date	Locality	Comments/collections
28 Mar. 1837	Woolnorth	
30 Mar. 1837	Woolnorth	*Cardamine heterophylla* var. *minor* TYPE
15 Apr. 1837	Circular Head	
28 May 1837	Woolnorth	(Lander 1988)
2 June 1837	Circular Head, bluff	
Mid-June 1837	To Hobart and return	Arrival of Sir John and Lady Franklin in Tasmania
10 July 1837	Circular Head, bluff	
17 Aug. 1837	Black River	
28 Aug. 1837	Circular Head, near sand hills	
1 Sept. 1837	Circular Head	
1 Sept. 1837	Circular Head, bluff	
16 Sept. 1837	Point Rapid, Tamar [River]	
21 Sept. 1837	Woolnorth	
30 Sept. 1837	Circular Head	
1 Oct. 1837	Circular Head	
10 Oct. 1837	Circular Head	
16 Oct. 1837	Woolnorth	
21 Oct. 1837	Hunter Island	
21 Oct. 1837	Barren Island [Hunter Island]	
21 Oct. 1837	Robbins Island	
26 Oct. 1837	Woolnorth	
27 Oct. 1837	Circular Head	
28 Oct. 1837	Circular Head, sand hills	
30 Oct. 1837	Circular Head	
1 Nov. 1837	Circular Head	
4 Nov. 1837	Circular Head, lagoon	
4 Nov. 1837	Circular Head, Palungra	
6 Nov. 1837	Circular Head	
7 Nov. 1837	Circular Head	
8 Nov. 1837	Circular Head/Forest	*Tetratheca procumbens* TYPE
13 Nov. 1837	Forest	
13 Nov. 1837	Circular Head	
15 Nov. 1837	Circular Head	
15 Nov. 1837	Circular Head, bluff	
17 Nov. 1837	Circular Head	
18 Nov. 1837	Circular Head, bluff	
20 Nov. 1837	Circular Head, Bluff Creek	(Lander 1988)
23 Nov. 1837	Circular Head, Western Plains	
24 Nov. 1837	Woolnorth [?]	
24 Nov. 1837	Circular Head, Western Plains	
27 Nov. 1837	Black River	
27 Nov. 1837	Detention River/Rocky Cape	
27 Nov. 1837	Rocky Cape	*Blandfordia punicea*
28 Nov. 1837	Circular Head	(Lander 1988)
1 Dec. 1837	Circular Head, lagoon nr log fence	*Pterostylis nutans*
2 Dec. 1837	Circular Head, side bluff	
4 Dec. 1837	Circular Head	*Leucopogon australis*
10 Dec. 1837	Circular Head, neck	
10 Dec. 1837	[Circular Head] Sandhills marsh	
11 Dec. 1837	Log Fence Lagoon	
11 Dec. 1837	Circular Head, bluff	
11 Dec. 1837	West Lagoon	
12 Dec. 1837	Circular Head, neck	
12 Dec. 1837	Circular Head	
13 Dec. 1837	Circular Head	
18 Dec. 1837	Circular Head	
18 Dec. 1837	Back Lagoon	
25 Dec. 1837	Circular Head	*Microtis arenaria*, *Asperula subsimplex* TYPES
26 Dec. 1837	Circular Head	
26 Dec. 1837	Circular Head, neck	
29 Dec. 1837	Rocky Cape	
29 Dec. 1837	Sisters Hills	
29 Dec. 1837	Crawfish Creek, nr. Circular Head	
30 Dec. 1837	Black River Run, sandhills	
30 Dec. 1837	Brickmakers Bay	*Tetrarrhena juncea*
1 Jan. 1838	Rocky Cape	*Danthonia gunniana* TYPE
2 Jan. 1838	Back Lagoon	
8 Jan. 1838	Circular Head, neck	
12 Jan. 1838	Forest	
12 Jan. 1838	Circular Head	
12 Jan. 1838	Circular Head, neck	
18 Jan. 1838	Circular Head	*Agrostis aequata* TYPE
18 Jan. 1838	Log Fence Lagoon	
20 Jan. 1838	Launceston	(Mackaness 1947)
22 Jan. 1838	Depart Launceston for Flinders Id.	(Mackaness 1947)
25 Jan. 1838	Goose Island	
26 Jan. 1838	Flinders Island [Wybalenna]	Vice-regal visit to Flinders Island

Table I — *continued*

Date	Locality	Comments/collections
27 Jan. 1838	Circular Head [?]	
5 Feb. 1838	Circular Head	
8 Feb. 1838	Circular Head	
8 Feb. 1838	Circular Head, neck	
10 Feb. 1838	Circular Head	
10 Feb. 1838	Black River	
12 Feb. 1838	Circular Head	
22 Feb. 1838	Rocky Cape	
1 Mar. 1838	Woolnorth	*Juncus caespiticius*
10 Mar. 1838	Circular Head, neck	
9 Apr. 1838	Circular Head, neck	
16 Apr. 1838	Woolnorth	
Apr. 1838	To Hobart and return	
May 1838	Circular Head	
10 July 1838	Circular Head	
20 Aug. 1838	Hampshire Hills	
21 Aug. 1838	Hampshire Hills	
21 Aug. 1838	Emu Bay Road	
22 Aug. 1838	Emu Bay Road	
27 Aug. 1838	Black River	
28 Aug. 1838	Circular Head	
1 Sept. 1838	Circular Head	
1 Sept. 1838	Forest	*Tmesipteris billardieri*
15 Sept. 1838	Circular Head	
22 Sept. 1838	Woolnorth, Castle Rock	
1 Oct. 1838	Circular Head	
1 Oct. 1838	Circular Head, neck	
4 Oct. 1838	Rocky Cape	
5 Oct. 1838	Rocky Cape	
5 Oct. 1838	Crawfish Creek, near Circular Head	
8 Oct. 1838	Circular Head	
14 Oct. 1838	To Hobart, takes up residence there	
29 Oct. 1838	Launceston, Cataracts, S.Esk River	
10 Dec. 1838	To Recherche Bay by ship *Eliza*	With Lady Franklin. Unable to proceed to Port Davey (Mackaness 1947)
12 Dec. 1838	Recherche Bay	
13 Dec. 1838	Recherche Bay	
13 Dec. 1838	Whale Head	
13 Dec. 1838	Towards South Cape	*Agastachys odorata*
14 Dec. 1838	Recherche Bay	
15 Dec. 1838	Recherche Bay	
15 Dec. 1838	South Cape	*Leptinella intricata* (*Cotula reptans*) TYPE
17 Dec. 1838	Island in Recherche Bay	
18 Dec. 1838	Catamaran River, Recherche Bay	
20 Dec. 1838	Catamaran River, Recherche Bay	
21 Dec. 1838	Southport Island	*Cyathodes abietina*
Dec. 1838	Returned to Hobart	
9 Feb. 1839	Mt Wellington inc. summit	
1 Mar. 1839	Hobart	(Lander 1988)
1 Mar. 1839	Mt Wellington [inc. summit]	
17 Apr. 1839	Hobart	
8 May 1839	Mt Wellington	With John Lillie
21 May 1839	Hobart	
1 Aug. 1839	O'Briens Bridge [Glenorchy]	
10 Aug. 1839	Hobart, Degraves	
10 Aug. 1839	Ancanthe	
7 Sept. 1839	Launceston	
11 Sept. 1839	Hobart, Degraves	
12 Sept. 1839	[O'Briens] Bridge [Glenorchy]	
8–15 Sept. 1839	Glen Leith	
15 Sept. 1839	New Norfolk	
23 Sept. 1839	Glen Leith	
25 Sept. 1839	Glen Leith	
27 Sept. 1839	Launceston, Cataracts, S.Esk R. [?]	
28 Sept.-13 Oct. 1839	Glen Leith	*Pomaderris pilifera*
18 Oct. 1839	Glen Leith	
19 Oct. 1839	Launceston [?]	
19 Oct. 1839	Hobart, nr. Simmons	
23 Oct. 1839	Hobart, Knocklofty	
24 Oct. 1839	Glen Leith	
27 Oct. 1839	Huon River	
30 Oct. 1839	Road from Huon[ville] to Hobart	?With Sir John and Lady Franklin.
2 Nov. 1839	New Norfolk	
2 Nov. 1839	Glen Leith	
4 Nov. 1839	Glen Leith	
6 Nov. 1839	New Norfolk	
6 Nov. 1839	Glen Leith	
10 Nov. 1839	Glen Leith	

Table I — *continued*

Date	Locality	Comments/collections
11 Nov. 1839	New Norfolk	*Eurybiopsis* (*Vittadinia*) *gracilis* TYPE
11 Nov. 1839	Glen Leith	
13 Nov. 1839	Glen Leith	
20 Nov. 1839	Hobart, Cascades	
20 Nov. 1839	New Norfolk	
21 Nov. 1839	Glen Leith	
28 Nov. 1839	Mt Wellington	
18 Dec. 1839	Married at Glen Leith	
26 Dec. 1839	New Norfolk, Rocks	
28 Dec. 1839	Glen Leith	
28 Dec. 1839	Hobart, Knocklofty	
5 Jan. 1840	New Norfolk	*Stipa stuposa* TYPE
6 Jan. 1840	New Norfolk	
8 Jan. 1840	New Norfolk	
20–29 Jan. 1840	Hobart	
25 Jan. 1840	Marsh Farm, Derwent	
31 Jan. 1840	Mt Wellington	
Feb. 1840	Creek at Bilton's, Glenorchy	(Lander 1988)
2 Feb. 1840	Glen Leith	
15 Feb. 1840	Bridgewater	
15 Feb. 1840	Derwent [River] 14 miles from Hobart	*Myriophyllum pedunculatum* TYPE
15 Feb. 1840	New Norfolk	
22 Feb. 1840	Macquarie Plains	*Pleurosorus rutaefolius*
23 Feb. 1840	Hobart	(Lander 1988)
1 Mar. 1840	Marlborough	?Gunn
3 Apr. 1840	Oyster Bay	?Gunn
Apr. 1840	Prossers River, Spring Bay	?Gunn
25 Apr. 1840	Mt Wellington	
13 May 1840	Mt Wellington	
18 May 1840	Mt Wellington	
July 1840	Mt Wellington	(Lander 1988)
5 Sept. 1840	Mt Wellington	
15 Sept. 1840	Hobart, Degraves	
16 Sept. 1840	Hobart, Sassafras Valley	
18 Sept. 1840	Glen Leith	
22 Sept. 1840	Glen Leith	
23 Sept. 1840	Kangaroo Bottom	Probably Lenah Valley, Hobart
24 Sept. 1840	Hobart, Sandy Bay	
28 Sept. 1840	New Norfolk	
28 Sept. 1840	Glen Leith	
1 Oct. 1840	Hobart	
7 Oct. 1840	Hobart, Sassafras Valley	
10 Oct. 1840	Risdon	*Eucalyptus risdonii* — With J. D. Hooker
12 Oct. 1840	Clarence Plains	With J. D. Hooker
12 Oct. 1840	Risdon	With J. D. Hooker
12 Oct. 1840	Grass Tree Hill	With J. D. Hooker
14 Oct. 1840	Glen Leith	
19 Oct. 1840	Derwent [River]	?With J. D. Hooker
24 Oct. 1840	New Norfolk	
24 Oct. 1840	Glen Leith	
26 Oct. 1840	New Norfolk	
27 Oct. 1840	New Norfolk	
27 Oct. 1840	To Huon	
29 Oct. 1840	My allotment [Hobart]	(Lander 1988)
30 Oct. 1840	Mt Wellington	
3 Nov. 1840	New Norfolk	
4 Nov. 1840	New Norfolk	
5 Nov. 1840	New Norfolk	
9 Nov. 1840	Hobart, Knocklofty	
13 Nov. 1840	New Norfolk	
14 Nov. 1840	Hobart, Degraves	
15 Nov. 1840	New Norfolk	*Agrostis billardieri* var.*setifolia* TYPE
16 Nov. 1840	Hobart, Knocklofty	
20 Nov. 1840	Mt Wellington	
20 Nov. 1840	Hobart, Degraves	
27 Nov. 1840	Hobart	*Persoonia juniperina* var.*brevifolia* TYPE
27 Nov. 1840	Risdon	
27 Nov. 1840	Grass Tree Hill	
8 Dec. 1840	New Norfolk	
9 Dec. 1840	New Norfolk	(Lander 1988)
11 Dec. 1840	New Norfolk	
12 Dec. 1840	Hobart, Degraves	
14 Dec. 1840	Hobart, Degraves	
18 Dec. 1840	Glen Leith	
18 Dec. 1840	New Norfolk	
20 Dec. 1840	New Norfolk	
28 Dec. 1840	Glen Leith	

Table I — *continued*

Date	Locality	Comments/collections
31 Dec. 1840	New Norfolk	
4 Jan. 1841	Marlborough	*Ranunculus pascuinus* TYPE
5 Jan. 1841	Marlborough	*Myriophyllum pedunculatum* TYPE
7 Jan. 1841	Lake St Clair	*Persoonia gunnii*, *Isoetes gunnii* TYPES
8 Jan. 1841	Road from Lake St Clair, c.8 miles	*Pentachondra ericaefolia* TYPE
9 Jan. 1841	Marlborough, Nive [River]	
12 Jan. 1841	Hobart, Degraves	
12 Jan. 1841	Glen Leith	
25 Jan. 1841	George Town	
29 Jan. 1841	Mt Wellington	With John Lillie
31 Jan. 1841	Mt Wellington	
Feb.-July 1841	To Launceston, takes up residence	
Apr. 1841	Disabled by broken leg	
2 Aug. 1841	Launceston	*Chiloglottis reflexa*
23 Aug. 1841	Launceston, Penquite	
1 Sept. 1841	Formosa	
18 Sept. 1841	Launceston	
20 Sept. 1841	Launceston	*Euphrasia gunnii* TYPE
28 Sept. 1841	Launceston, Penquite	*Eriostemon verrucosum*
29 Sept. 1841	Corra Linn, North Esk [River]	
2 Oct. 1841	Launceston, Penquite	
9 Oct. 1841	Launceston, Penquite	
14 Oct. 1841	Launceston, Penquite	
16 Oct. 1841	Launceston, Penquite	
20 Oct. 1841	Launceston, Penquite	
29 Oct. 1841	Formosa	
1 Nov. 1841	Launceston, Penquite	
2 Nov. 1841	Launceston, Penquite	
10 Nov. 1841	Launceston, Penquite	
13 Nov. 1841	Launceston, Distillery Creek	
13 Nov. 1841	Launceston, Penquite	
14 Nov. 1841	Launceston, Penquite	
18 Nov. 1841	Middle Arm [Tamar River]	
18 Nov. 1841	George Town	
19 Nov. 1841	Launceston, Penquite	
1 Dec. 1841	George Town	*Burchardia umbellata* var.*parviflora* TYPE
3 Dec. 1841	Point Effingham	
3 Dec. 1841	George Town	
6 Dec. 1841	Road from George Town	
6 Dec. 1841	Mt Direction [Tamar River]	
13 Dec. 1841	Launceston, Penquite	
18 Dec. 1841	Glen Leith	
18 Dec. 1841	New Norfolk	*Gonocarpus vernicosus* TYPE
24 Dec. 1841	Launceston, Penquite	
30 Dec. 1841	Launceston, Penquite	
22 Jan. 1842	Launceston, Penquite	
19 Feb. 1842	George Town	
19 Feb. 1842	Road to/from George Town	
19 Feb. 1842	Mt Direction [Tamar River]	
22 Mar. 1842	Spring Hill, summit	
26 Mar. 1842	South Esk River at Launceston	*Doodia media*
Apr. 1842	Launceston, Penquite	
4 June 1842	Launceston	
18 July 1842	George Town	
23 Aug. 1842	Thomson's farm, Pipers River	
27 Aug. 1842	Launceston, Penquite	
10 Sept. 1842	Launceston, Penquite	
20 Sept. 1842	Launceston, Penquite	*Euphrasia gunnii* TYPE
23 Sept. 1842	South Esk River at Launceston	
24 Sept. 1842	South Esk River at Launceston	
10 Oct. 1842	Launceston, Penquite	
17 Oct. 1842	Epping Forest	*Acacia gunnii*
20 Oct. 1842	Point Effingham	*Pultenaea hibbertioides*
21 Oct. 1842	Road to Point Effingham	
21 Oct. 1842	Road to George Town	
22 Oct. 1842	George Town	
22 Oct. 1842	Curries River	
24 Oct. 1842	[George Town?] My allotment	
24 Oct. 1842	Rd to Pt Effingham nr Mt Direction	*Pimelea nivea*
4 Nov. 1842	New Norfolk	
5 Nov. 1842	Campbell Town	
15 Nov. 1842	Epping Forest	
16 Nov. 1842	Macquarie Plains	May be a Mary Ballantyne collection
20 Nov. 1842	Road near Mt Direction	
20 Nov. 1842	George Town	
21 Nov. 1842	Point Effingham	
21 Nov. 1842	George Town to Cimitiere Plains	*Angianthus eriocephalus*, *Asperula minima* TYPES

Table I — *continued*

Date	Locality	Comments/collections
22 Nov. 1842	George Town	
23 Nov. 1842	Road from George Town	
24 Nov. 1842	Launceston, Penquite	
28 Nov. 1842	Point Effingham	
5 Dec. 1842	Launceston, Penquite	
6 Dec. 1842	Brumby's Punt	*Discaria pubescens*
7 Dec. 1842	Formosa	
8 Dec. 1842	Longford, Reid's Punt	
8 Dec. 1842	Norfolk Plains	
10 Dec. 1842	Launceston, Penquite	
19 Dec. 1842	George Town	
24 Dec. 1842	Road to Thomson's farm, Pipers R.	
24 Dec. 1842	10 miles north of Launceston	*Euphrasia gunnii* TYPE
24 Dec. 1842	Launceston, Penquite	
26 Dec. 1842	Launceston, Penquite	
2 Jan. 1843	George Town	
3 Jan. 1843	George Town	(Lander 1988)
4 Jan. 1843	York Town	
9 Jan. 1843	George Town	
9 Jan. 1843	Cimitiere Plains	*Banksia gunnii* TYPE
10 Jan. 1843	George Town	
11 Jan. 1843	Asbestos Hills	
18 Jan. 1843	George Town	
19 Jan. 1843	Cimitiere Plains	
20 Jan. 1843	George Town	
20 Jan. 1843	Cimitiere Plains	
23 Jan. 1843	Thomson's farm, Pipers River	*Epacris gunnii*
27 Jan. 1843	George Town	
27 Jan. 1843	Five Mile Bluff	
28 Jan. 1843	Five Mile Bluff	
28 Jan. 1843	Three Mile Bluff	
28 Jan. 1843	George Town	
29 Jan. 1843	Point Effingham	
16 Feb. 1843	Western Mts [Tiers]	
18 Feb. 1843	Western Mts [Tiers]	
18 Feb. 1843	Bradys Lookout, summit	
18 Feb. 1843	West Arthurs Lake	
18 Feb. 1843	Arthurs Lakes	*Eucalyptus gunnii* TYPE
23 Mar. 1843	Launceston, Penquite	
24 May 1843	South Esk River	*Callitris oblonga*
5 July 1843	George Town	
5 July 1843	Point Effingham	
13 Sept. 1843	Derwent, New Norfolk	
20 Sept. 1843	Launceston, Penquite	
29 Sept. 1843	Formosa	
1 Oct. 1843	Launceston, Penquite	
2 Oct. 1843	St Patricks River	
10 Oct. 1843	Launceston	
11 Oct. 1843	Launceston, Penquite	
14 Oct. 1843	South Esk River, Launceston	
15 Oct. 1843	George Town	
23 Oct. 1843	George Town	*Cassytha tasmanica* TYPE
23 Oct. 1843	Point Effingham	
24 Oct. 1843	George Town	
24 Oct. 1843	Road to/from Curries River	
26 Oct. 1843	Asbestos Hills	*Tetratheca gunnii*, *Epacris virgata* TYPES
27 Oct. 1843	George Town	
28 Oct. 1843	George Town	
1 Nov. 1843	Launceston, Penquite	(Lander 1988)
4 Nov. 1843	Billopp	
4 Nov. 1843	Formosa	
6 Nov. 1843	Lake River, Formosa	(Lander 1988)
6 Nov. 1843	Formosa	
6 Nov. 1843	Road between Perth & Launceston	
8 Nov. 1843	Launceston, Penquite	
9 Nov. 1843	Launceston, Penquite	
11 Nov. 1843	Launceston, Penquite	
15 Nov. 1843	George Town	
15 Nov. 1843	Point Effingham	*Dichondra repens*
16 Nov. 1843	Point Effingham	
16 Nov. 1843	George Town, near windmill	
23 Nov. 1843	Mt Direction [Tamar River]	
6 Dec. 1843	Franklins leave Tasmania	
10 Dec. 1843	Glenelg River, Victoria	
20 Dec. 1843	Western Mtns [Tiers], summits	*Haloragis montana*, *Epacris petrophila* TYPES
21 Dec. 1843	Billopp	
15 Jan. 1844	George Town	

Table I — *continued*

Date	Locality	Comments/collections
25 Jan. 1844	York Town	
25 Jan. 1844	George Town	
5 Feb. 1844	Portland Bay area, Victoria [?]	
20 Apr. 1844	Launceston, Penquite	
24 Apr. 1844	George Town	
15 May 1844	Launceston, Penquite	
Sept.-Oct. 1844	Circular Head (A return visit)	(Willis 1966)
Oct. 1844	George Town	Large collection of marine algae
10 Oct. 1844	Launceston, Penquite	
11 Oct. 1844	Launceston, Penquite	
12 Oct. 1844	Launceston, Penquite	
21 Oct. 1844	West Head, George Town/Tamar	
23 Oct. 1844	George Town	
23 Oct. 1844	York Town	
24 Oct. 1844	York Town	
24 Oct. 1844	Asbestos Hills	*Cyathea australis*
24 Oct. 1844	George Town	
26 Oct. 1844	Point Effingham	
28 Oct. 1844	Point Effingham	
28 Oct. 1844	George Town	
4 Nov. 1844	Formosa	
4 Nov. 1844	Brumbys Creek	
11 Nov. 1844	Launceston, Penquite	
16 Nov. 1844	Diddleum, 2000 ft, St Patricks R.	*Ranunculus lappaceus* TYPE
17 Nov. 1844	Cataracts, South Esk River	
21 Nov. 1844	George Town	
24 Nov. 1844	George Town	
29 Nov. 1844	Launceston, Penquite	
1 Dec. 1844	Launceston, Penquite	
2 Dec. 1844	Launceston, Penquite	
7 Dec. 1844	Launceston, Penquite	
9 Dec. 1844	Launceston, Penquite	
9 Dec. 1844	Brumbys Creek, Formosa	
10 Dec. 1844	Launceston, Penquite	
14 Dec. 1844	Launceston, Distillery Creek	*Pimelea filiformis* TYPE
14 Dec. 1844	St Patricks River	
17 Dec. 1844	Cataracts, South Esk River	
17 Dec. 1844	Launceston	*Meteorium filipendulum* TYPE
21 Dec. 1844	South Esk River at Perth	
23 Dec. 1844	St Patricks River	
24 Dec. 1844	Launceston, Penquite	
1 Jan. 1845	Launceston, Distillery Creek	
16 Jan. 1845	Western Mtns [Tiers] 2000 ft	
17 Jan. 1845	Arthurs Lakes	*Lilaeopsis brownii*, *Ranunculus pascuinus* TYPES
17 Jan. 1845	Western Mtns [Tiers], summit	
17 Jan. 1845	Mtns north of Arthurs Lakes	*Ranunculus concinnus* TYPE
18 Jan. 1845	South Esk River at Fentons Ford	*Isoetes elatior*; exact location uncertain
30 Jan. 1845	Lake River at the Den	
1 Feb. 1845	Nive [River]	
3 Feb. 1845	Marlborough	*Pentachondra ericaefolia* TYPE
3 Feb. 1845	Lake St Clair	
7 Feb. 1845	Franklin River	*Epacris franklinii* TYPE
8 Feb. 1845	Near Franklin River	
8 Feb. 1845	White Hill Plains	*Epacris corymbiflora* TYPE
9 Feb. 1845	Detention Corner	
9 Feb. 1845	Calders Pass	
9 Feb. 1845	Acheron River	*Splachnum* (*Tayloria*) *gunnii* TYPE
10 Feb. 1845	Acheron River	
10 Feb. 1845	Glow Worm Forest	*Archeria eriocarpa* TYPE
10 Feb. 1845	Painters Plains	
10 Feb. 1845	Calders Pass, towards Franklin R.	
10 Feb. 1845	Detention Corner	
10 Feb. 1845	Loddon River	
10 Feb. 1845	Surprise River	
11 Feb. 1845	Fatigue Hill	*Boronia citriodora* TYPE
11 Feb. 1845	Lake St Clair	
12 Feb. 1845	Six Mile Creek, beyond L. St Clair	
13 Feb. 1845	Lake St Clair	*Persoonia gunnii* TYPE
17 Feb. 1845	South West of Lake St Clair	
18 Feb. 1845	Lake River, Grindelwald	
27 Feb. 1845	Launceston, Penquite	
15 Mar. 1845	Launceston, Distillery Creek	
1 Apr. 1845	St Patricks River near Launceston	
17 May 1845	Western Mtns [Tiers], summit	*Pernettya lanceolata* TYPE
9 Aug. 1845	Western Mtns [Tiers], summit	
1 Sept. 1845	Launceston, Penquite	
28 Oct. 1845	St Patricks River	

Table I — *continued*

Date	Locality	Comments/collections
3 Nov. 1845	Launceston, Penquite	
5 Nov. 1845	Macquarie R. c. 30 miles S. Launceston	*Myriophyllum integrifolium* TYPE
5 Nov. 1845	Billopp	
6 Nov. 1845	Mackersey's, Macquarie [River]	
8 Nov. 1845	Launceston, Penquite	
5 Dec. 1845	George Town	
7 Dec. 1845	Launceston, Penquite	
7 Dec. 1845	Formosa	
6 Jan. 1846	Penquite	(T. May, pers. comm.)
6 Feb. 1846	St Marys Pass	
7 May 1846	Launceston, Penquite	
20 Sept. 1846	Formosa	
Late Dec. 1846	Browns River [Kingston]	Marine algae (Gunn 1847b)
4 Jan. 1847	Marlborough to Lake St Clair	*Botrychium lunaria*
5 Jan. 1847	Mt Olympus, summit	*Cheesemania radicata, Epilobium tasmanicum* TYPES
6 Jan. 1847	West side of Lake St Clair	
6 Jan. 1847	North end of Lake St Clair	
6 Jan. 1847	East side of Lake St Clair	*Allocasuarina monilifera*
7 Jan. 1847	South end of Lake St Clair	
8 Jan. 1847	South-west side of Lake St Clair	
9 Jan. 1847	Lake St Clair, near outlet	
21 Jan. 1847	Launceston	
1 Apr. 1847	Port Phillip, Victoria	
1 Feb. 1848	Waterhouse Point	*Allocasuarina paludosa*
2 Feb. 1848	Little Forester River, on coast	
14 Oct. 1848	Arthurs Lakes	*Hutchinsia tasmanica* TYPE
14 Oct. 1848	Little Lakes	
24 Oct. 1848	Diddleum Plains	
27 Oct. 1848	Near north coast, [near Bridport]	
29 Oct. 1848	North coast at Little Pipers River	*Ricinocarpus pinifolius*
1 Dec. 1848	Formosa	
2 Dec. 1848	Formosa	*Lilaeopsis gunnii* TYPE, *Trithuria submersa*
2 Dec. 1848	Low Park, Formosa	*Isoetes drummondii*
19 Dec. 1848	Formosa	*Isoetes elatior, Pilularia novaehollandiae*
4–10 Mar. 1849	Western Tiers	
9 Mar. 1849	Meander River, falls	*Athrotaxis cupressoides*
25 Sept. 1850	Diddleum	
1 Sept. 1851	Launceston, Penquite	
Oct. 1851	North-west Tasmania	No known collections. (Gunn 1855)
Oct 1853	Circular Head to Woolnorth	No known collections. (Gunn 1855)
3 Apr. 1855	W. H. Harvey visits Gunn, Launceston	(Unpublished letter, Harvey to Gunn, A.O.T.)
24 Nov. 1856	Welcome River, Woolnorth	(Lander 1988)
14 Feb. 1857	Middlesex Plains	(Lander 1988)
1859	Mersey to Inglis Rivers	No known collections
26 Mar. 1859	Diddleum	*Pimelea pauciflora*
Feb. 1860	Surrey Hills	*Boronia anemonifolia*
13 Mar. 1881	Gunn died at Newstead House	

years later he was also to take on the management of the Franklin properties on Sir John's recall to England. These included Lady Franklin's private botanical garden 'Ancanthe' at Lenah Valley, Hobart. Through these years Gunn was the leading member of the Tasmanian Society which was later combined with the Royal Society of Tasmania (Burns & Skemp 1961).

One of Gunn's major disappointments must have been his disablement during 1841–1842 with a broken leg. This prevented him from accompanying the vice-regal overland expedition to Macquarie Harbour on Tasmania's west coast (Baulch 1961). Joseph Milligan joined the expedition in Gunn's place and despite the many delays and difficulties encountered (Burn 1955) a small botanical collection was made. In 1845 however, Gunn followed the route of the 1842 expedition at least as far as the Franklin River (see Fig. 1) where he collected the type of *Epacris franklinii* (= *E. mucronulata*). There is no evidence to suggest that he progressed beyond the Franklin River and not having a boat, he would have had difficulty negotiating the lower Gordon River to Macquarie Harbour.

From his home in Launceston he made frequent trips to the heathlands of the George Town area, to the Lawrence estate 'Formosa' in the midlands and also to the mountains near Arthurs Lakes and St Patricks River.

As well as dried herbarium specimens, Gunn despatched to Kew 'Wards Cases' containing living plants collected on his excursions. He also collected animals for the British Museum, including the now extinct Tasmanian emu. His efforts were encouraged and rewarded by the Hookers with gifts of books, garden plants and other materials in return (Burns & Skemp 1961).

Gunn's last major collecting expedition was to Mt Olympus in January 1847 accompanied by John Jamieson, Mr B. Brooks and two others (Gunn 1847b). His specimens from the rocky crest (1,447 m) were the first collections of the flora of the summits of Tasmania's central high mountains. Among the new discoveries were *Nothofagus gunnii*, *Cheesemania radicata* and *Epilobium tasmanicum*. After 1847 the number of his collections drops away sharply. He relied more and

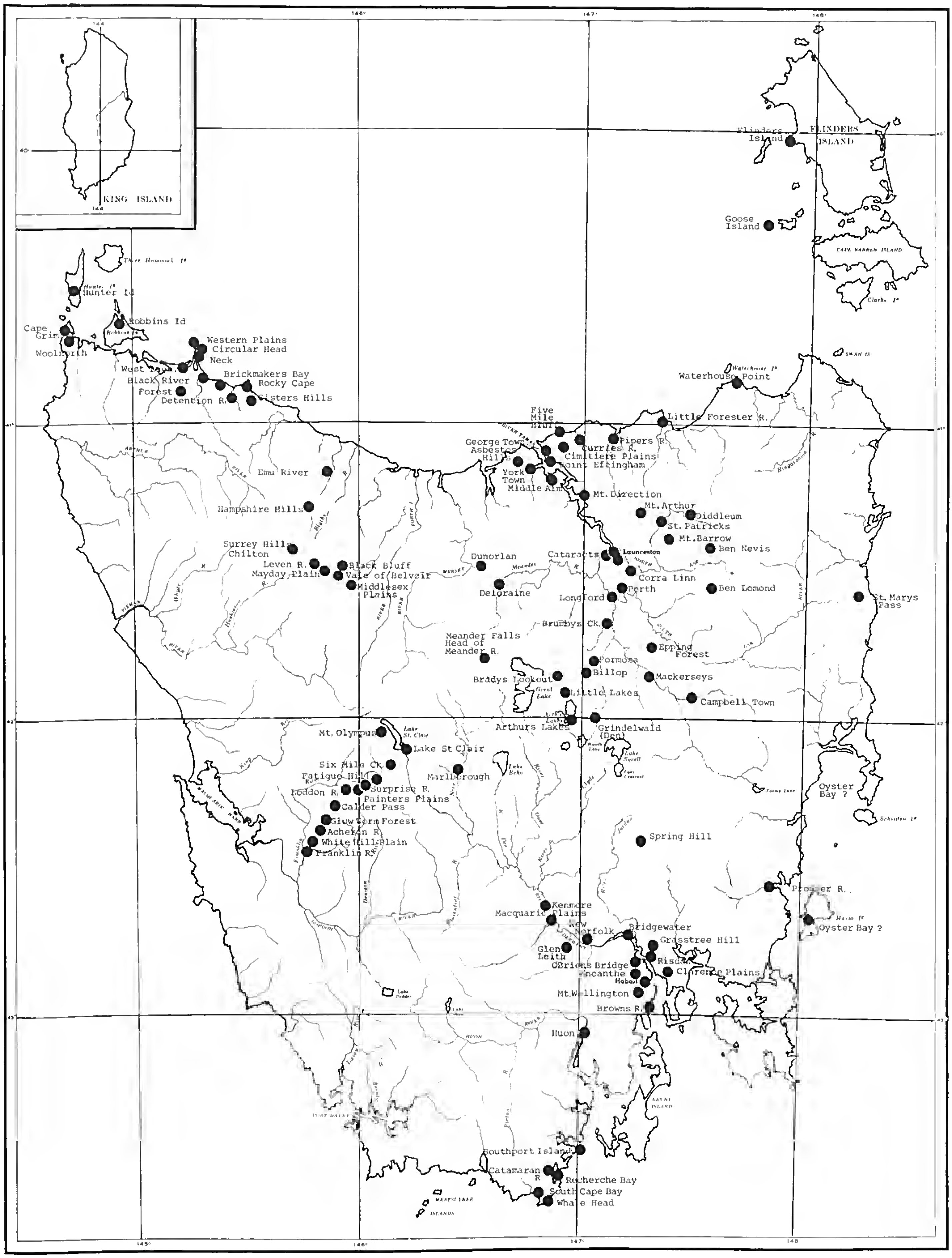

Fig. 1. The Tasmanian collecting localities of R. C. Gunn from 1832 to 1860.

more upon other collectors but even their interest had waned (Daley 1936). The last collections that I have located are dated 1859 and 1860; one specimen in each year.

Early in 1855, the well known Irish phycologist W. H. Harvey visited Tasmania and called on Gunn during his time in Launceston (Harvey 1855). Harvey later dedicated a volume of his *Phycologia Australica* to Gunn in appreciation of the specimens he had received (Harvey 1863).

During the 1850s, Gunn acted as Launceston agent for the Van Diemen's Land Company (A.O.T. V.D.L. 33, 42) and in his later years he took an active interest in public affairs. From 1855 to 1860 he held a seat in the House of Assembly, though he was often absent. He later held such public positions as Deputy Commissioner of Crown Lands, Agent for the Real Property Act, Clerk of the Peace, and Deputy Recorder of Titles. As well, he took an active interest in various local societies and companies (Baulch 1961).

Gunn's writings have appeared in a number of publications, the first being his own *The Circular Head Scientific Journal*, produced in long hand from June 1836 to about 1837, and containing mainly ornithological papers. He later published in the *Tasmanian Journal of Natural Science*, and in its successor the *Papers and Proceedings of the Royal Society of Van Diemen's Land* and elsewhere. As well as contributing botanical papers (Gunn 1842a; 1842b; 1846a; 1846b; 1847b; 1854), he took a deep interest in zoology (Gunn 1836 *et seq.*; 1838; 1845; 1847a; 1849; 1851a; 1851b; 1852a; 1852b; 1852c; 1852d) and coastal morphology (Gunn 1855). No doubt his most valuable writings were the descriptive notes that accompanied the specimens that he sent to K; these were of great value to Hooker in preparing his *Flora Tasmaniae*. Gunn also collaborated with Backhouse (1835) in his *Index plantarum* . . . , Tasmania's first locally produced popular Flora.

In 1878, Gunn presented his herbarium to the Royal Society of Tasmania and it was housed at the Tasmanian Museum. This valuable collection, containing many isotypes, remained largely uncurated until about 1904 when it was moved to the National Herbarium of NSW. Subsequently a set of duplicates and other miscellaneous material from his herbarium was returned to Tasmania and is now housed at the Tasmanian Herbarium, Hobart. These collections include a large amount of material passed to Gunn by other collectors, especially Milligan.

Gunn retired from his government positions in 1876 and lived in his Launceston home 'Newstead House' in failing health. He died there on 13 March 1881 and was buried in the old Scotch Burial Ground, Launceston. He left 10 children but none of his descendants now bear the surname Gunn (Burns & Skemp 1961).

His Associates

Through his leadership of the Tasmanian Society Ronald Gunn became well known as an authority on the natural history of Tasmania. His intense interest in the flora flowed over to a number of other people who assisted him with his collections or passed on to him collections of their own. Gunn arranged these collections within his own numbering system and forwarded duplicates to Kew along with his own material. These contributory collectors were sometimes mentioned in Gunn's letters to Hooker and are often acknowledged on the labels of the specimens or duplicates that have remained in Australia.

Below is an annotated list of collectors whose material was included in Gunn's herbarium. They are arranged chronologically by the date of their earliest collection.

Robert W. Lawrence

Lawrence was probably Tasmania's earliest resident collector and began about 1829 in the Launceston area where his father was a wealthy land owner. He made the first collections, including the type of *Podocarpus lawrencii*, from the mountains south west of Launceston and collected widely in the Western Tiers, which rise close behind his family property 'Formosa'. Gunn and Lawrence became close friends until Lawrence's untimely death in 1833, after which his collections were included in Gunn's herbarium (Burns & Skemp 1961). These bear the initials RWL and usually a Lawrence number.

George Moran

Moran was a gardener from Dundee, Scotland, was transported to Tasmania as a convict and assigned to work on the Lawrence Estates at Launceston. His convict record gives his occupation as gardener and botanist (A.O.T. CON 78/2). Moran accompanied Robert Lawrence on his collecting trips from about 1829 to 1831. He was assigned to Captain Moriarty (A.O.T. CON 31/29) of Dunorlan, near Deloraine, and accompanied Gunn on a collecting trip to the nearby Mersey River and Meander Falls in January 1833 (Gunn 1834). A small number of his collections have survived, presumably as part of Lawrence's herbarium and are usually labelled GM in Gunn's handwriting.

James Backhouse

Backhouse came to Tasmania in 1832 as a missionary and collected from Cape Grim to Hobart over the period 1832 to 1834 (Backhouse 1843). At the former locality he collected the type of *Correa backhousiana*. He contributed two papers to *Ross's Hobart Town Almanack*. . . (Backhouse 1834; Backhouse and Gunn 1835). A small number of his collections were included in the Gunn herbarium, almost all bear Backhouse's original labels but have been annotated by Gunn.

Richard H. Davies

Davies collected on the east coast of Tasmania from about 1833, probably as a consequence of Backhouse's visit. He held land at St Helens near which he collected the type material of the now extinct *Phebalium daviesii*. He forwarded his collections to Hooker via William Archer of 'Cheshunt' (Hooker 1859) and for this reason very few are found in the Gunn herbarium.

Joseph Milligan

While surgeon on the Van Diemen's Land Company's Hampshire Hills/Surrey Hills grazing block near Burnie, Milligan became acquainted with James Backhouse and forwarded specimens to Gunn in 1834 for shipment to Kew (Burns & Skemp 1961). Milligan

collected most actively in the 1840s (Buchanan 1988b) when he was stationed at Flinders Island and Macquarie Harbour and a large number of these specimens were included in the Gunn herbarium. Many bear Milligan's original labels while others, probably duplicates retained by Gunn, bear transcriptions in Gunn's hand. Milligan left Tasmania in 1860.

John George Robertson
Robertson was manager of the Lawrence estate, 'Formosa', after Robert Lawrence's death. He forwarded collections to Hooker in 1837 before moving to the Glenelg River, Victoria in 1841. Gunn received collections of Victorian plants from him and also visited him in later years (Burns & Skemp 1961).

George Fordyce Story
Story was a doctor at 'Kelvedon', Great Swanport, on Tasmania's east coast and a friend of James Backhouse. He collected in the Swanport area from about 1837 and was director of the Hobart Botanic Gardens in 1842–1843. A small number of his collections found their way into Gunn's herbarium and are identifiable only by Story's distinctive handwriting and by the Swanport area localities.

Charlotte Smith (née McDonald)
Charlotte Smith, wife of John Grant Smith (below) and collector friend of Gunn's when they lived at Circular Head, collected mainly orchids and marine algae in the Circular Head area in 1837–1838. The orchidaceous genus *Macdonaldia* commemorates her work and several marine algae bear the epithet *smithiae*. She died in Launceston in October 1838. Labels bear the initials CS in Gunn's hand.

John Grant Smith
Smith lived in Launceston after his wife's (above) death and in 1839 collected a small number of specimens, mostly small herbaceous plants. These bear the initials JGS and a collecting number in Gunn's hand.

James Lee
Lee was a convict from Surrey, England, he arrived in the *Waterloo* on 2 March 1835; his convict record gives his occupation as gent's servant and bird stuffer. He became Gunn's assigned servant following Gunn's requests for a 'bird-skinner' and served him for several years; he received a conditional pardon in May 1843 (A.O.T. CON 18/21). I have encountered two specimens, one from Launceston dated October 1838 and another from Mt Wellington, both labels are in Gunn's hand.

John Lillie
The Reverend Lillie was a Presbyterian Minister in Hobart and married Gunn at 'Glen Leith' in December 1839. He accompanied Gunn on local collecting excursions such as to the summit of Mt Wellington in May 1839. His labels bear the initials JL.

Joseph D. Hooker
The botanist J. D. Hooker, son of William J. Hooker and author of *Flora Tasmaniae*, visited Tasmania in 1840 and 1841. He collected widely in the Hobart and Port Arthur areas and on an excursion to the upper Derwent River area in October 1840. In 1841 he visited the Richmond and Huon areas. A small number of Hooker's collections (probably his duplicates) from these excursions are to be found in Gunn's herbarium.

Mary Ballantyne
Mary Ballantyne collected in the New Norfolk and Macquarie Plains area from October 1840 to November 1842. Her family held pastoral properties at Hayes and Kenmore, north-west of New Norfolk. The monotypic endemic genus *Ballantinia* was later named in her memory — she collected the original specimen. Her specimens are labelled in Gunn's hand and bear the initials MB.

Charles Stuart
Stuart collected in Tasmania from 1842 to about 1857 especially in the Perth area, on the east coast and in the Mt La Perouse area. He forwarded almost all of his material to Mueller but in 1849 (Daley 1935) he lamented that Gunn had 'made away with' specimens loaned to him. Perhaps these included Stuart's collections of *Cyphanthera tasmanica* which at K are attributed to Gunn; Haegi (1982) concluded that Gunn never collected this species. Similarly, at HO there is a sheet of *Epacris squarrosa* (*E. tasmanica*) from Gunn's herbarium, collected at Brushy River near Swansea by Stuart, which is probably the duplicate of a sheet at K labelled Oyster Bay, East Coast, by Gunn. The latter label gives no date of collection which further indicates that Gunn was not the collector and there is no good evidence that Gunn ever collected in that area. A small number of Stuart's specimens, mainly fragments, are to be found in Gunn's herbarium. As his initials are the same as Charlotte Smith's, Gunn usually wrote C. Stuart in the lower left of his labels. There is also another suite of specimens at HO that bear distinctive labels and are attributed to Stuart.

William Archer
Archer collected in the 1840s and 50s, especially in the vicinity of his property 'Cheshunt', near Deloraine, in the north of Tasmania. Archer and Gunn were opposed in their political views but did occasionally meet on friendly terms or go collecting together. In 1857 Archer took his herbarium to England and assisted Joseph Hooker, both monetarily and as a botanical artist, in the production of *Flora Tasmaniae* (Hooker 1859). A very small number of Archer's specimens are discernible in Gunn's herbarium.

William H. Breton
Breton was a leading citizen of Richmond and Hobart during the 1840s and contributed a paper on a journey in the Western Tiers between Lake River and the Liffey River to the Tasmanian Journal (Breton 1846). In this he described the method used for the collection of cider from *Eucalyptus gunnii* and, with Gunn's help, included a short list of plants seen in the area. I have encountered only one of his specimens, collected in the mountains: it is undated.

Other undated and thus far unknown collectors are Wm Watkins, R.K.N. and J.C.U. Their collections are few in number.

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Explorers, institutions and outside influences: botany north of Thursday

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Abstract

Although collections had been made in coastal areas by several expeditions before 1840, botanical investigation of Papuasia on a larger scale began only in the 1870s. Until after World War II it was almost entirely in a primary phase, characterised by exploration, documentation and description, and very much influenced by individual interests as well as prevailing patterns of interior penetration, administrative control and official support. The size of New Guinea and the extent and interest of the region's flora, particularly in the mountains, were such that botanists and collectors ventured there from many countries, including, especially in the late 19th century, several from Australia or under Australian sponsorship. After 1900, however, Australian contributions fell sharply and up to 1941 most undertakings originated in metropolitan countries north of the Equator or in the Indies. Although no one nation was, or could be, dominant, the gap left by the end of German exploration after 1914 has attracted much comment. A growing dispersion of resources and publications, first seriously noted in the 1930s, was effectively tackled by Dutch botanists who were then well placed for this task. Their work of integration, aided by colleagues in other countries, has continued through *Flora Malesiana* and related publications but is far from completed and has been made harder by the loss of resources at Berlin-Dahlem in 1943. The end of the primary era may be marked by Brass's vegetation survey of 1941 and the start of *Flora Malesiana*.

From 1945, with domestic renewal in Australia, the expansion of science and higher education, and increased economic and political commitments to dependent territories in Papuasia, opportunities for local development of the sciences greatly improved. Australian involvement in Papuasian botanical work increased and diversified, both through the new Division of Botany in Lae and by contributions from CSIRO, ANU and others. Basic primary activities continued, leading to a doubling of available collections by the mid-1970s, and were joined by expanded efforts in geobotany, plant protection, plant biology, and ethnobotany. This second phase may be said to have ended with publication of J. Linsley Gressitt's *Biogeography and ecology in New Guinea* (Gressitt 1982).

Independence in Papua New Guinea and the Solomons coincided with the emergence of a pattern of lower economic growth both in the region and in Australia. Support for botany has again fallen for this and other reasons, including changing government priorities and poor organization of the sciences. While many useful publications have appeared, they reflect no long-term plan. A major flora project was initiated in the 1970s but it is something of a 'dream edifice' and its future appears very uncertain, with only two volumes published. Without new initiatives botanical work in Papuasia is likely to remain at a low level for some time.

Contents

Introduction

As with the protagonists in Jon Cleary's 1960 novel *North from Thursday*, the most lasting impression one forms after a study of the history of botany in New Guinea is of a mosaic, in which Australians were but one of many elements. To the immense and still poorly documented lore of the many tribal nations has been added, through the work of men and women from diverse outside lands, a patchy formal understanding of Papuasian plant life.

Although the visitors perforce have dominated organized study, the 812,000 km^2 of the second largest island in the world and its satellites, some not small, were too large and varied (and for long too impenetrable) ever to be the exclusive preserve of a single country. New Guinea (and, by extension, Papuasia) provides, as not many other parts of the world can, an opportunity for comparing the aims, efforts and results of scientific expeditions and other forays from many countries, and for examining the growth, when it did come, of a resident botanical community.

Sustained botanical exploration began relatively late, as did serious efforts to bring about consolidation of scattered knowledge, a task which began in the 1930s and still continues. Basic plant inventory, description and classification dominated for the first eighty years. Only from the 1950s was there an extensive development of other areas of plant biology along with interdisciplinary fields such as vegetation history and Quaternary studies. Even so, the groundwork is far from complete, and deeper levels of botanical thought are yet little explored (cf. Stevens 1989). Existing surveys (Paijmans 1976; van Royen 1980; Gressitt 1982) are, and can only be, samplers.

A major part of any consolidation and development programme should be the bringing together of the historical record. For the natural sciences generally, August Wichmann's encyclopaedic *Entdeckungsgeschichte von Neu-Guinea* (Wichmann 1909–1912) was an important start. This was added to by several scholars in W. C. Klein's *Nieuw-Guinée* (Klein 1935–1938). For botany we have the brief overall surveys by White (1922), Lam (1934, 1935) and Womersley (1953) in addition to the important *Malaysian plant collectors and collections* and its supplements by M. J. van Steenis-Kruseman (van Steenis-Kruseman 1950–1974). More specialized area or subject reviews, as well as gazetteers, have begun to appear only in recent years (e.g. Vink 1965, van Royen 1980, Croft 1983, Veldkamp, Vink & Frodin 1988).

Analyses, however, have so far been relatively few. Following my contribution to a narrative survey (Frodin & Gressitt 1982) I recently made an attempt to examine the history of exploration in Papuasia in terms of the natural sciences as a whole (Frodin 1988). Among my conclusions was that a principal motivation for sustained natural history exploration, when it did come, was the search for birds of paradise and bower birds and other novelties. Botanical exploration in its own right, with the exception of Rudolf Schlechter's tours of German New Guinea and Lilian Gibbs's pioneer vegetation studies at the Angi Lakes in western New Guinea, began only after World War I. Prior to then plant collecting and study was largely the province of organized general expeditions on sea and land, interested naturalist-explorers such as Alfred Russel Wallace, Odoardo Beccari, Luigi d'Albertis, Henry Ogg Forbes and Carl Lauterbach — and some resident officials, planters and missionaries.

The pioneer expeditions and individual naturalists naturally had support from interested advocates and sponsors, mostly in Europe. Among the most zealous, however, was Ferdinand von Mueller, then Government Botanist of Victoria. Along with many others, he was caught up in the 'New Guinea fever' which began to sweep Australia from the late 1860s as thoughts of new frontiers and concern over foreign activities took hold (Macmillan 1957). As a result, Australians were involved in collecting almost from the beginning of sustained New Guinea exploration in the 1870s. In this paper I shall concentrate on the botanical record, mainly from 1871, with emphasis on the Australian involvement.

I. Exploration

A. Early history: glimpses of riches

Although the Englishman William Dampier is usually credited with the first known botanical observations in Papuasia, made in 1700 on his voyage in the *Roebuck*, the plant life of the region was not in fact entirely unknown. Taxonomic revisions are gradually showing that many species, particularly of low- and medium-altitude trees, were actually first recorded in the Moluccas by that seventeenth-century 'Plinius indicus', Georg Eberhard Rumpf. But the late publication of his *Herbarium amboinense*, the difficulty in interpretation of many of its illustrations in the absence of associated collections, assumptions about plant distribution, and other factors all contributed to the development of a 'separate' Papuasian taxonomy, particularly east of Dutch territory.

Dampier's few records were added to fairly extensively during the late eighteenth and early nineteenth centuries. These, however, rested almost entirely on the work of short calls by exploring voyages — the then-Lt. James Cook stayed only a day, early in September 1770 — at a small number of points. While the

French made the most visits, only the materials of Alexander Zipelius, who as a member of the Indies Natural Sciences Commission stayed two months in 1828 at the pioneer Dutch settlement in Triton Bay, materially increased knowledge of the land flora. As published by Carl Blume in his serial *Rumphia*, they were used by Friedrich A. W. Miquel in his *Flora indiae batavae* (Miquel 1855–1859) — and especially the Swiss botanist Heinrich Zollinger, who postulated for the lowland flora a relationship with what he called the 'flora Malesiana' (Zollinger 1857) — to make some first, very tentative conclusions about the New Guinea flora and its relationships. But about the extensive mountainous regions Zollinger and others could only speculate. Until the 1870s and the advent of sustained inland exploration these inaccessible areas would remain botanically unknown.

B. First fruits: European entry and expansion, 1871–1883

This period covers the rise of a wide European and Australasian interest in New Guinea, its first climax in 1875, decline, and subsequent renewal as geopolitical developments influenced the issue of the island's future.

I have elsewhere described (Frodin 1988) some of the developments which led up to the great increase in activity by naturalists in New Guinea. Among significant pressures which would break down the region's isolation were the growing dependence of the expanding world economy on the production and transportation of natural products and plantation crops, increasing competition of the great European powers in the Pacific, and the emergence of Australia as a force in its own right. Calls began to be heard, both in Europe and Australia (Lang 1871), for opening up the country to white settlement.

Natural history also played a key role. What seems to have been an effective catalyst in the opening up of New Guinea was the still-current interest in natural history 'novelties', among them orchids and other ornamental plants, not to mention animals and plants of actual or potential economic value, including, notably, bird-of-paradise plumes. But at the beginning of the 1870s New Guinea was still rarely visited and access for scientists difficult. Travel on naval vessels was sometimes possible — the Italians Luigi d'Albertis and Odoardo Beccari, and the Russian Nikolai Miklucho-Maclay, between them probably most responsible for stimulating a sustained interest in New Guinea natural history, were able at times to enjoy this privilege — but such movement was dependent on political and strategic perceptions. Local suspicion of unusual activities prevailed. Most naturalists, and particularly botanists, were perforce dependent on the spread of formal economic and mission activity or were 'added on' to voyages and expeditions made for other or more general purposes.

The three intrepid individuals just mentioned were from countries with little or no prior involvement in the Southwestern Pacific. Their decision to go to New Guinea was for scientific reasons. Doubtless they were influenced by the English naturalist Alfred Russel Wallace's recently-published *The Malay Archipelago*, a work which ever since has inspired young naturalists to visit the 'eastern tropics'. But the explorers' respective mentors, Giacomo Doria in Genoa and Karl von Baer in St Petersburg, also knew it was a new frontier. And they were not disappointed: from Andai (south of Dorei Bay), d'Albertis and Beccari entered the 'forbidden' mountains for the first time in September 1872. Beccari was to return twice more, alone, in 1875–1876.

Beccari, d'Albertis and, to a lesser extent, Maclay nevertheless were viewed with suspicion (Goode 1977) — although Beccari later allayed any fears. Along with other developments, such as alleged Italian and German colonization schemes and the arrival of British missionaries in the Torres Straits, such foreign travellers induced the Dutch to increase their presence in western New Guinea. Further east, the British became concerned about the growth and management of the Queensland labor trade, stepping up naval patrols in Melanesia from their Sydney station, and increasing trade through the Torres Straits and China Strait (at the eastern tip of New Guinea). The Australian colonies also began to be concerned about security on their northern frontier, as well as the activities of Russia and other powers in the Pacific.

The Dutch response took the form of a series of naval patrols. To this end, on 12 August 1871 their ship, the *Dassoon*, sailed from Ternate on the first of several voyages. With this voyage, the Dutch may be credited with the initiation of serious and sustained plant collecting in New Guinea. On board was the veteran Buitenzorg (Bogor) plantsman, Johannes Teysmann — the first Dutch botanist to visit New Guinea since Zipelius.

While the fruits of this voyage of some three months were relatively modest, Teysmann obtaining only 133 species, they were a beginning. As Teysmann himself had done, Wichmann (1909–1912, vol. 2, p. 150) criticized this voyage for providing few collecting opportunities. But, in his 1876 report on the plants, the director of the *'s Lands Plantentuin* in Buitenzorg, Rudolph Scheffer, also incorporated earlier Dutch and French material. Among the latter were the records of Pierre-Adolphe Lesson made at Dorei Bay (on which the town of Manokwari now stands) in 1827 on Capt. Jules Dumont d'Urville's *Astrolabe* world voyage and published by Achille Richard as part of his *Sertum astrolabianum* (Richard 1834). A consolidated list of known western New Guinea plants at last existed, although Beccari's collections were not included and in another generation it would be out of date.

Scheffer also sent a good set of Teysmann's specimens to Ferdinand Mueller in Melbourne — perhaps thereby quickening his, and Australia's, interest in the New Guinea flora. Mueller, having been a member of the 1855–1856 North Australian Expedition of Augustus C. Gregory, was already aware that the flora of northern Australia differed in many ways from that of the south, and New Guinea and the islands of the Pacific were an extension of this awareness.

D'Albertis, and later Maclay and Beccari, would also turn to Australia for support. D'Albertis, recovering from illness in Sydney in 1873, had the good fortune there to befriend the noted local naturalist Dr George Bennett. Like Mueller, Bennett was a strong advocate of New Guinea exploration and subsequently lent his support, which for the Italian's

subsequent, more famous ventures proved vital (Goode 1977). Maclay also developed extensive contacts in Australia. Their work there did much to increase Australian interest in the natural world of New Guinea, of which plants were part.

Mueller, the most prominent botanist in Australia, unfortunately never would, or could, go himself, and it was not until 1898 that an Australian botanist reached New Guinea. From late in 1875, however, he would begin to receive a continuous flow of Papuasian plants at his 'Phytologic Museum' (now the National Herbarium of Victoria). Until his death in October 1896, nearly all plant collectors in eastern New Guinea, the New Britain (later Bismarck) Archipelago and the Solomons sent him their specimens, or good duplicate sets thereof. But of primary collections all were from amateurs, non-specialized naturalists or others, mainly Australian or British. The few professional botanists to reach New Guinea before 1898, including Beccari, worked up their collections in Europe. Enough arrived at Melbourne, however, for Mueller to publish over sixty papers on Papuasian plants.

In his first paper, Mueller acknowledged the growing public interest in New Guinea as a new frontier: 'a large island-country . . . stretching moreover into close proximity of the Australian Continent, must be to us here of special importance for commerce and colonisation . . . particularly at a time when the settlement along the opposite Australian coast is effected' (Mueller 1875, p. 3). This interest — termed 'New Guinea fever' both by Macmillan (1957) and Goode (1977) — had arisen at the end of the 1860s. In spite of some setbacks, interest was further heightened by favourable reports by Captain John Moresby who, from 1872 to 1876, undertook in the *Basilisk* a series of coastal surveys for the Royal Navy and who, early in 1873, 'discovered' the fine harbour on the south-east coast from whose shores Port Moresby now spreads (Moresby 1876; Thompson 1980, pp. 36, 39). These pressures culminated in a general meeting in Sydney in May 1875 which advocated annexation. Similar sentiments were voiced elsewhere in Australia. A few voices, however, urged caution. Among them was the editor of the *Sydney Morning Herald*, Andrew Garran, who, on the eve of the first serious Australian-sponsored expedition to New Guinea, wrote that 'English talent does not seem to lie in the direction of civilising inferior races' (Thompson 1980, p. 41).

The New Guinea expedition, however, had been organized for very different reasons. Personal, public and indeed proto-national interest had led William J. Macleay, nephew of the one-time Colonial Secretary Alexander Macleay and last of the naturalists in the Macleay family, to conceive early in 1874 the idea of an Australian scientific voyage. Following the visit of the British *Challenger* expedition in 1874 (and which would be in New Guinea waters late that year and early the next) Macleay resolved to go to New Guinea. Inspired by the work of the *Challenger* he planned the expedition mainly around collecting and research in marine biology and oceanography. Botany, however, was partly covered by two gardeners from his friend Sir William Macarthur's estate at Camden Park, one of them being J. Reedy who would assemble a small herbarium. For a ship he purchased the barque *Chevert*, an old French naval vessel which had seen long service in the Pacific, including convict transport (Macmillan 1957) and had her refitted.

The departure of the expedition, just days after the above-mentioned Sydney meeting, inevitably involved it in the political debate over New Guinea. Many annexationists may have thought that the voyage was connected with their movement; so had d'Albertis (Macmillan 1957, p. 150). But Macleay, it should be noted, was an opponent of unrestricted outside exploitation (Grattan 1963) and his hurried and apparently ignominious return by steamer in October 1875 — the *Chevert* followed later from Cape York — effectively 'killed off' an already waning colonization craze (Thompson 1980, p. 43). Fever, the greatest scourge of New Guinea, had stricken down Macleay off Yule Island late in August.

Although quite productive for marine biology — and thus for Macleay a success — the *Chevert* voyage was less so in matters geographical or botanical. Macleay never reached his main objective, the Fly River, and the gardeners concentrated on living plants (Macmillan 1957, p. 137). Nevertheless, the some 125 specimens obtained by Reedy included two species of *Eucalyptus*, one new, and such plants common to both Australia and New Guinea as *Dischidia nummularia*, *Elaeocarpus arnhemicus* and *Exocarpus latifolia*. The eucalypt discoveries, along with Beccari's 1872 finds of oaks [actually chestnut-oaks of the genus *Lithocarpus*] and other species with Asian affinities in the northwest, and the collections before the 1840s which pointed to an essentially Malesian flora, set the stage for the enduring interest of New Guinea in the study of plant biogeography. In the introduction to the first part of his series *Descriptive notes on Papuan plants*, Mueller called the flora a 'blending . . . of Australian forms . . . with Sundaic types of plants', noting that it would 'render to an Australian naturalist the study of the Papuan vegetation one of great significance' (Mueller 1875, p. 4).

The British government refused to sanction annexation of New Guinea and until the 1880s no more large-scale exploring expeditions from Australia would be mounted. Naturalists would have to be resident or find private or institutional sponsorship; the difficulties of terrain, climate, and human contact increasingly made it clear that serious efforts would require official backing. Mueller's fascination with New Guinea would remain, however. He had already interested the Congregational missionaries in New Guinea, beginning with Samuel Macfarlane, in collecting and in 1876 he received plants from d'Albertis and the commercial traveller Andrew Goldie. He also received some lots from New Britain, as we shall note later. The results filled four more issues of his *Descriptive Notes* as well as several other papers. Among them were descriptions of such fine plants as *Mucuna bennettii* from the Fly River and *Combretum goldieanum* from Port Moresby, along with further evidence for the close connections between the floras of New Guinea and northern Australia, particularly in the Trans-Fly area. But only with the entry of organized government into New Guinea would a 'particular charm' of Mueller, the comparison of its alpine flora with those of Australia [and New Zealand], be realized (Mueller 1876, p. 52).

C. British New Guinea, 1883–1918: the fragility of support

Renewed political pressures respecting New Guinea were felt from the early 1880s. It culminated in a unilateral annexation proclamation by Queensland on 4 April 1883 at Port Moresby and covered all non-Dutch territory. Though disallowed in London, this move eventually led to partition of eastern Papuasia and the establishment in November 1884 of organized administration, respectively German in the north and British, with Australian support, in the south.

Queensland's move, along with investigative reporting by the Melbourne newspapers *Age* and *Argus*, further raised interest in New Guinea. Geographical societies were formed, which with official and private support mounted a number of expeditions over the remainder of the decade, e.g. the 1885 *Bonito* expedition with botanist Wilhelm Bäuerlen (Wilson, this volume). These and work by private collectors renewed the flow of specimens, including plants for Mueller. In 1885 Mueller resumed publication of *Descriptive Notes.*

Two early administrators of British New Guinea had a scientific background. General Sir Peter Scratchley, in office during 1885, had been a military engineer in Australia. Sir William MacGregor, in office from 1888 to 1898, began colonial service as a medical officer. The former gave considerable assistance to Henry Ogg Forbes — a geographer-naturalist sponsored by the Royal Geographical Society and its sister bodies in Australia — on his arrival in the territory and visited Forbes's base camp on the Sogeri Plateau. MacGregor (partly in answer to criticisms of the various privately and semi-privately sponsored expeditions, notably that of Forbes which was seen as geographically unsuccessful) made natural history collecting a government responsibility. He assigned the work to designated officers, and undertook numerous expeditions and patrols, including Mt Victoria (in 1889) and other peaks in the Owen Stanley and Wharton Ranges. He also attempted to set up a botanical garden and begin investigations of potentially useful native plants, of which only one, *Ficus microcarpa* var. *rigo*, enjoyed any success.

An early fruit of MacGregor's work was a botanical collection from Mt Victoria — the first from any alpine region in New Guinea. Mueller, his 'particular charm' fulfilled, promptly wrote it up as *Records of observations on Sir William MacGregor's highland plants from New Guinea* (Mueller 1889). Mueller subsequently published scattered papers on further collections from MacGregor and others. But it was too much for one man with many other responsibilities — and insufficient resources, particularly at a time of economic depression in Australia. Indeed, at the time of his death Mueller reputedly had described 'only a small part of the Papuan material' which he had assembled (van Steenis-Kruseman 1958, p. [13]).

Particularly serious was failure to publish a full account of the Forbes herbarium, although its monocotyledons were early studied (Ridley 1886) and Mueller described a number of the more notable dicotyledons. Apart from the alpine plants, this collection was the most important of the period, comprising over 1,000 numbers from a hill region never before visited. But, due to misunderstandings with William Carruthers, then Keeper of Botany at the British Museum (Natural History), and changing interests on the part of Forbes neither of his two major collections — the other being from Java, Sumatra and Timor — was fully reported on until the 1920s (Rendle *et al.*, 1923, 1924–1926). The Museum did, however, become an important repository for New Guinea plants with its acquisitions of the Boden Kloss and Carr collections, which will be mentioned later.

Beccari also never completed study of his collections. Although appointed director of the botanical garden and herbarium at Florence in 1876, and having organized his serial *Malesia* (Beccari 1877–1890), he later took issue with some plans for development and administration of the herbarium (van Steenis 1982) and then withdrew from botany for several years. He returned as a specialist in palms and made important contributions to knowledge of the New Guinean species. His other plants, vascular and non-vascular, were largely described by specialists.

Following Mueller's death, MacGregor arranged to have his last large collection, from the higher parts of the Wharton range, identified at Kew. This soon appeared as *Flora of British New Guinea* (Hemsley *et al.* 1899). But it was to be for decades Kew's only major contribution to New Guinea systematic botany, its staff under William Thistleton-Dyer and for long afterwards being most concerned with Africa. In 1898, shortly before the end of his New Guinea service, the by-then Lieutenant-Governor arranged with the Queensland Government that Frederick Manson Bailey, their Colonial Botanist, should assume responsibility for botanical services to British New Guinea. Bailey visited the colony in that year on a tour of inspection with Governor Lord Lamington, the first by a professional botanist from Australia. He was, however, never able to contribute more than minimally, having few resources and being always more than fully preoccupied with Queensland affairs.

Bailey, however, was not the first Queensland biologist to visit the area. In 1895 Henry Tryon, a naturalist and entomologist who shortly before had joined the Queensland Department of Agriculture, collected sugar-cane varieties. Several, especially 'Badila', were to be very useful to the Queensland sugar industry (Steenis-Kruseman 1950, p. 533; Bolton 1972, p. 239). More germplasm expeditions, for sugar and other crops, would follow in the twentieth century.

Local government efforts in the natural sciences, including plant collecting, rapidly declined after MacGregor's departure and remained so for several decades, save in a few areas directly related to the economy. Although Lieutenant Governors George R. le Hunte and Francis R. Barton contributed some collections for Bailey, most of what little work was done from 1898 to 1918 was under private auspices. The most substantial lots received by Bailey were from Mrs Mary Schleneker and Copland King. Schleneker, of Brisbane, and the wife of a Congregationalist missionary, collected in inland parts of the Rigo District. King, of Sydney, was a founder in 1891 of the Anglican Mission in New Guinea. He specialized in orchids and pteridophytes from that mission's field in present-day Oro and Milne Bay Provinces.

Some of King's material also reached Sydney, where Joseph Henry Maiden had, from the mid-1890s, been

energetically developing the herbarium at the Royal Botanic Gardens. Maiden also was able to attract other Papuasian collections, including some from F. H. Brown collected on the Varirata Plateau near Port Moresby (forwarded through his employers, Burns, Philp & Co. of Sydney) and Richard Parkinson in New Britain, who earlier had sent material to Mueller. But, in spite of his acquisition of these and other valuable extra-Australian resources, Maiden, like Bailey, had little or no opportunity to develop a sustained interest in floristic work outside his State.

The advent of the Federal government brought few new initiatives for support of scientific work in New Guinea — not surprisingly for a body which was only gradually establishing itself and lacked resources or a tradition for sustained support of the sciences. In botany, criticism by Colonel Kenneth Mackay, writing for the 1906 Royal Commission on British New Guinea (Australia 1907, p. lxiv) and, shortly afterwards, a lengthy submission by Maiden, with proposals to the Chief Secretary (Maiden 1923), elicited no response. Until World War II the Commonwealth made no really significant direct contribution to New Guinea botany save for its sponsorship of Charles E. Lane-Poole's forest survey of 1922–1924. A 1908 survey, on behalf of the Department of External Affairs, by Gilbert Burnett, a Queensland forest inspector, was botanically unproductive (White 1922, p. 11).

All these problems were symptomatic of what was essentially an ephemeral interest within the countries from which the explorers and naturalists of the 1870s and 1880s had chiefly come. Resources could no longer be spared for New Guinea once initial curiosity had been satisfied and decisions of state made. Without such support, the economy and administration of British New Guinea, and later Papua, could support only the barest minimum of scientific work. It is to MacGregor's credit that he accomplished as much as he did, but in the absence of dedicated metropolitan assistance neither Mueller, Bailey, the British Museum or Kew could undertake effective consolidation of botanical knowledge. In any case Kew was shifting responsibility for some of its work to the 'periphery' (Brockway 1979). Greater centralization of major collections and a different approach to science and development in their colonies would soon give the Germans, and later the Dutch, a significant overall 'lead' in New Guinea botany which they enjoyed for a quarter-century and beyond.

D. German New Guinea, 1884–1914: a flash of brilliance

The advent, from November 1884, of a formal German presence in northeastern New Guinea and the nearby major and minor islands of the renamed Bismarck Archipelago and the northern Solomons, brought in an increased effort in natural history. Previous German contacts with the region had been sporadic, although increasing from the 1870s. In 1875 came the first major German expedition to the region, on its world cruise in the warship *Gazelle* under Capt. G. E. G. Freiherr von Schleinitz. The botanical collections, made by the ship's surgeon Friedrich Naumann, were written up by the still relatively-young Adolf Engler, then at Kiel University, and other specialists. But Germany, and above all, the Royal Botanical Museum in Berlin, was not to build up its celebrated New Guinea holdings until after annexation. The contributions of the individual Germans who followed the entry of mercantile enterprise, such as Carl Walter, Ernst Betche, and, after his settlement in the area in 1882 as a planter, Richard Parkinson — though relatively modest and perforce nearly all from coastal parts of the Bismarck Archipelago — mostly flowed to Melbourne, like those from the future British New Guinea. Only the naturalist (and intelligence agent) Otto Finsch, better known as an ethnographer, zoologist and geographer, sent his reportedly few plant collections 'home'.

The picture changed sharply after annexation of the area and the foundation, beginning in 1885, of Finschhafen and other stations by the New Guinea Company. The Company, under the direction of the Berlin banker Adolph von Hansemann, in its early years invested heavily in exploration. Botany progressed in concert with other activities, and the mounting of the New Guinea Expedition of 1886–1887 under the leadership of Carl Schrader to look at the virtually unknown interior included a young botanist, Udo Max Hollrung. This expedition, though not entirely fulfilling instructions or expectations (Wichmann 1909–1912, vol. 2, p. 413, 455), set an important precedent: exploration was to be carried out primarily for science and development and not, as in British New Guinea, with pacification, control and the introduction of native administration as the main aims. The Germans 'walked less but recorded more' (Firth 1982, p. 161). Over the next decade and a half, with the work of various expeditions and individuals, botanical knowledge of German New Guinea, in terms of numbers of specimens collected, caught up with British New Guinea by 1900 — even though to some contemporary observers scientific exploration seemed to be lagging (Mackellar 1912, p. 178). Following publication of *Die Flora der deutschen Schutzgebiete in der Südsee* and its *Nachträge* (Schumann & Lauterbach 1901, 1905), and especially after 1907 when, with the advent of a separate Colonial Office and representations by Governor Albert Hahl additional support became available for the colony, progress became even more rapid. Additional collecting (particularly by Rudolf Schlechter, Carl Ledermann, Karl Rechinger, Leonhard Schultze-Jena, the Rev. Christian Keysser, and Rev. Father Gerhard Peekel), the production of Schlechter's *Die Orchidaceen von Deutsch-Neu-Guinea* (Schlechter 1911–1914, 1982) — for which he will be long remembered (Timler & Zepernick 1987, p. 151) — brought in as many as 15,000 specimens in seven years. The initiation (in 1912), under Carl Lauterbach's direction and with the support of a private foundation, of the series *Beiträge zur Flora von Papuasien*, published in Engler's *Botanische Jahrbücher für Systematik*, provided a major outlet for systematic revisions. By 1914 German botanists were well ahead of those of Australia or, indeed, of any other country.

Contemporary writers took note of the disparity in knowledge. Carl Lauterbach (Lauterbach 1911, p.22), not without some German pride, remarked: 'Was zunächst Englisch-Neu-Guinea anbetrifft, so ist daselbst in der letzten Zeit für die botanische Erforschung nur sehr wenig geschehen' — a sharp change from the era of 'der . . . hochverdiente Gouverneur'

MacGregor. Only the Dutch were, as he acknowledged (and as we shall see below) — 'vom 1903 ab beginnt jedoch eine lebhafte Tätigkeit' — catching up in consequence of their major exploration programmes and, from 1909, publication of *Nova Guinea*. By 1916 Ridley was to write in his *Report on the botany of the Wollaston Expedition to Dutch New Guinea, 1912–13:* 'The flora of British New Guinea has been more neglected than that of Dutch and German New Guinea; except for Forbes's collections on the Sogeri Mountains, which have not yet been fully worked out, and a small lot obtained by Macgregor and Giulianetti, no collecting of importance has been done there' (Ridley 1916, p. 2). This comment, however, clearly took note only of results published in British journals. Mueller's contributions were considerable, if scattered, and the mass of material which he accumulated in Melbourne would represent a valuable, if imperfect, future resource for the British New Guinea flora.

Beside work and publications noted above, German scientists (and contemporary visitors from other countries, among them the Swede Erik Nyman and the Hungarian Lajos Biró) were also responsible for confirming the predominantly Malesian character of the lowland flora over most of New Guinea (Warburg 1891, 1892); the initiation of serious collecting of bryophytes (one of the leading moss specialists of the day, Max Fleischer, visited in 1903) and other non-vascular cryptogams, fungi and lichens (fully accounted for in Schumann and Lauterbach's volumes); a vegetation map and zonation scheme (Lauterbach in Meyer 1910); economic botanical studies (by Kaernbach, Warburg, and Schlechter among others); the establishment of a botanical garden (in 1906, in the new town of Rabaul); the first exploration of Bougainville Island (cf. Rechinger & Rechinger 1908); detailed local floristic work, firstly in the Gazelle Peninsula by Friedrich Dahl (Schumann 1898) and later there and in New Ireland by Father G. Peekel (Peekel 1985); a successful exploration of an alpine flora (by Christian Keysser, in 1912); and, thanks particularly to the work of Schlechter and Ledermann as well as Lilian Gibbs in western New Guinea (see below), a conscious sampling of a wide variety of habitats and, later, the idea that the [lower] montane flora was part of a pan-austral assemblage probably of great antiquity (Diels 1921).

The German contribution, which in the field ended in 1914 but continued long afterwards in publications, has been much praised and certainly far exceeded British and Australian efforts in southeastern New Guinea during the period, especially after 1900. Not unsurprisingly, however, it owes more to individual work than to official efforts, in view of the focus of German colonial interests (including the *Botanische Zentralstelle*, formed in 1891 at the Berlin Botanical Garden and Museum) on Africa (Timler & Zepernick 1987). That much was accomplished in New Guinea was to a goodly extent due to the personal efforts of Carl Lauterbach and Governor Hahl, not to mention the collectors in the field along with expedition leaders such as Walter Behrmann. Inevitably the impetus slackened and, while the *Beiträge* continued to appear until 1942, no *Die Pflanzenwelt Papuasiens* ever eventuated and German contributions to New Guinea botany would all but cease after World War II.

E. Eastern New Guinea, 1914–42: private progress

Soon after the outbreak of World War I, German New Guinea, after a brief struggle near Blanche Bay, fell to the Australian Naval and Military Expeditionary Force on 13 September 1914 and remained under military rule until May 1921, when it became a Mandated Territory of the League of Nations under Australian administration. Little botanical work was done during this period. Some collecting was done by the planter, Wilhelm Bradtke, in the Duke of York Islands and by the missionaries Gerhard Peekel in New Ireland and Christian Keysser (sometimes with the German surveyor and fugitive Capt. Hermann Detzner) on the mainland. By contrast, Papua, an external territory of Australia, enjoyed a new and more favourable period of botanical exploration beginning even before the end of the War in November 1918. This was due to continuity of the Australian administration under Sir Hubert Murray and the appointment as Queensland Government Botanist in that year of Cyril T. White, a grandson of Bailey and the first notable native-born Australian systematic botanist. White was for years interested in the rainforest flora of Queensland and, as 'consultant botanist' to the Papuan administration, he could extend this interest to New Guinea and the Solomons.

Official Australia generally was all but indifferent to extensive study and development of the New Guinea territories — save in terms of potential economic gain. It was only the personal policies and efforts of Murray which gave Papua its distinctively 'liberal' reputation in Australian and British colonial circles. Following a 1919 commission of inquiry, what became the Mandated Territory of New Guinea was, in 1921, effectively reorganized as a commercial colony. German interests were expropriated and positions and properties offered to returned Australian servicemen. Alexander (1972, p. 79) has argued that these factors were at least partly responsible for 'the poor quality of . . . government . . . during the postwar decade'. In Germany, Walter Behrmann, the former leader of the 1912–1913 Sepik Expedition who was now a geographer at the University of Berlin, would be critical of the precipitous fall in exploration and scientific work, noting also, as have some subsequent writers, that development and administrative control in some areas had actually deteriorated (Behrmann 1924). Charles Rowley, of the Australian School of Pacific Administration in Sydney, wrote in 1958 that 'the Australian administration seems to have been more despotic and repressive than its predecessor' (McKillop & Firth in Denoon & Snowden 1981, p. 100).

An exploring expedition was organized by the Commonwealth in 1921, using a small ship, the *Wattle*, to explore parts of the Mandated Territory with the aim of assessing economic potential. In particular, the team looked at the Ramu Valley which had first attracted German attention twenty-five years before. Although a forester, H. W. Haynes, accompanied the trip (Angus 1972, p. 448), no botanical material evidently was obtained. The following year, as part of forest resource investigations for the relatively new Australian Forest Service, the Commonwealth Inspector-General of Forests, Charles E. Lane-Poole, undertook extensive surveys in both Papua (May 1922 to February 1923) and New Guinea (November 1923 to

October 1924). The resulting report, *The forest resources of the territories of Papua and New Guinea* (Lane-Poole 1925), is one of the classics of New Guinea botanical literature, including as it does the first extensive, well-illustrated review of the vegetation of eastern New Guinea. White, together with his Queensland Herbarium associate William D. Francis, identified the plants. Like Mackay and Maiden before him, Lane-Poole was critical of the decline in botanical exploration. He wrote (1925, p. 69) that 'it is a thousand pities that the systematic work so ably begun by Sir William MacGregor in 1889 in Papua should have been allowed to drop, and that no steps were taken to describe the flora of Papua until Mr White's visit in 1921 [actually 1918]. As for the Territory of New Guinea, the work of German scientists appears to have been wholly lost'. But official indifference continued, and until the mid-1930s private parties dominated botanical work in the Mandate.

The same lack of official concern was evident in the applied sector. A reputedly capable Director of Agriculture in the Mandated Territory, George Bryce, resigned, apparently frustrated, after less than three years (1923–1926). 'His scientific background and tropical experience rested awkwardly on Australian institutions' (McKillop & Firth in Denoon & Snowden 1981, p. 100). The contrast with the German era would also be noted by his successor, George Murray (Shurcliff 1929, p. 202). Lane-Poole's proposals for a Forest Service languished until 1938 when, in response to increasing local demand for timber and growing exports (particularly of New Guinea walnut, *Dracontomelum dao*; d'Espessis 1940), two foresters were appointed to the administration (Womersley 1953).

A positive legacy of the Bryce era was, however, his revival of the German plans for an experimental plantation in Keravat, realized in 1928 (now the Lowlands Agricultural Experiment Station of the Papua New Guinea Department of Agriculture and Stock). Both he and Murray maintained and further developed the botanical garden in Rabaul established by the Germans, endowing it with a growing reputation as a beauty spot (Michener 1951). From 1934 a small herbarium was built up under the agricultural botanist R. E. P. Dwyer (Frodin 1985). Few trips, however, were made. Among these was one by G. S. Gee to collect material of the citrus relative, *Clymenia polyandra*, for the economic botanist and citrus specialist Walter T. Swingle in the United States (van Steenis-Kruseman 1950, p. 187). The Forestry Service collections were, though useful, likewise not extensive.

Some of the private contributions, by contrast, were outstanding. Leonard Brass, as well as the collector and prospector S. F. Kajewski, both supported by the Arnold Arboretum through White, worked extensively in the Solomon Islands (including, in Kajewski's case, Bougainville), reaching higher elevations not previously examined by botanists. Kajewski later contributed an account of his experiences (Kajewski 1946). The Australian missionary teacher J. H. L. 'Harry' Waterhouse was engaged by British government interests to collect in the Solomons (including Bougainville); later he worked near Rabaul while teacher at a Government school. Serious collecting in the upper Watut basin (Morobe Province) was initiated by the anthropologist Beatrice Blackwood in 1936. The Japanese botanists Ryozo Kanehira and Sumihiko Hatusima collected briefly in various centres in 1937. But all these efforts were overshadowed by the zealous collecting from 1935 of Mary S. Clemens, mainly in the Huon Peninsula north of Lae but also elsewhere in present-day Morobe Province. Her over 12,000 numbers were collected on a subscription basis, in the first instance for the Berlin Botanical Museum and, after the outbreak of World War II in Europe, for the University of Michigan. She continued to collect right up until her forced evacuation in December 1941 from Lae, and was so active in Australia until about 1950 (Langdon 1981; Carter 1982; Conn, this volume).

The predominance of private expeditions, both in the Mandated Territory and in Papua, stands in strong contrast to the Dutch East Indies at this period. This low level of scientific concern for the vast New Guinea domains has, however, to be viewed as part of a larger picture. Australia lacked the institutions, as well as the interest (beyond economic) to mount effective research programmes in New Guinea. At Federal level, serious concern for the development of the sciences had begun only in 1916 (Alexander 1972, pp. 66–68). The Council for Scientific and Industrial Research [later the Commonwealth Scientific and Industrial Research Organisation (CSIRO)] came into being in 1926 but played no role in New Guinea until after World War II. Botanical departments in the universities were small, and the opportunities for research extremely limited. It was the time of the 'long trough' (Donaldson & Good in Denoon & Snowden 1981, p. 143). That Lane-Poole's report became something of lasting worth was due to the hard work and dedication of the leader and his collaborators.

From 1918, however, botany seemed to enjoy a better hearing in Papua. Earlier I noted that an informal agreement with Queensland had enabled the Government Botanist there to act in an honorary capacity for British New Guinea (and, later, Papua). Murray invited White to Port Moresby soon after the latter's appointment. White's six week long visit in July and August of 1918 marked the beginning of a long and fruitful association with Papuasian botany, ending only with his death in 1950. Beside his own contributions, White was to promote exploration by others, using funds from a variety of sources. Among his most important moves was recommending a young assistant from Toowomba, Leonard J. Brass, to Charles Sprague Sargent — then nearing the end of his long tenure as director of the Arnold Arboretum of Harvard University — as collector for a proposed Papuan expedition, its first in the region. As he had done almost throughout his career, Sargent was interested in learning about new trees and other woody plants and obtaining herbarium specimens.

Brass undertook the expedition for Sargent in 1925–1926, obtaining nearly 1,200 well-collected numbers. The woody plants were studied by White and others, giving White his third long contribution to the New Guinea flora (White 1929). Sargent's plans for a second expedition were suspended due to his death (Sutton 1970, p. 345); but the work of White and Brass apparently stimulated the garden-loving and cricket-playing minister/principal of the Congregational seminary in Papua, Richard Lister Turner, to collect from time to time. After contributing lots respectively in

1918 and 1925 (from Rigo) and 1930 (from Fife Bay) he settled and collected at Delena on Hall Sound. In 1928 came the New Guinea Sugar Expedition, supported by the U.S. Department of Agriculture and the first to use an airplane for scientific exploration in the Australian territories (Sinclair 1978). Its botanist was Jacob Jeswiet from the Dutch East Indies. Beside sugar strains, plant collections were made in the Sepik as well as the then Central and Western Divisions of Papua.

The several biological and botanical expeditions of the 1930s were all privately sponsored. Among corporate ventures, the most important surely are the Archbold expeditions. In 1933–1934 the American Museum of Natural History in New York, under the leadership of the mammalogist and oil millionaire Richard Archbold, mounted the first of its seven New Guinea expeditions, which worked from Hall Sound (near Yule Island) to Mt Albert Edward, utilizing a trail system built by the Roman Catholic Sacred Heart Mission. For this, Brass was engaged as botanist. Further expeditions followed in 1936–1937 (Western District of Papua), 1938–1939 (western New Guinea), 1953–1954 and 1956–1957 (Milne Bay District of Papua), and 1959 and 1964 (northeastern New Guinea), on all of which Brass participated except the last. The Archbold expeditions, organized as small teams, had comprehensive objectives and were designed to sample altitudinal transects, thus covering as many habitats as possible in a given area. Those of 1936–1937 and 1938–1939, like the Sugar Expedition before them, made extensive use of air transport (Sinclair 1978). The plants of the first three trips were, along with those of a number of individual collectors, 'worked up' under the direction of Elmer D. Merrill in the United States. The resulting papers, by several authors including Merrill and his associate Lily Perry, were published almost entirely in *Brittonia* and the *Journal of the Arnold Arboretum* under the general title *Botanical Results of the Archbold Expeditions*. Appearing from 1935 until 1954, they represent the work of the only serious American research programme to date on the Papuasian flora. White and his associate Stanley Blake also contributed, the latter all the Cyperaceae.

Individual collectors included the Russian (and later Swiss) Paul Wirz, looking at wild rice in western Papua in 1930, the British naturalist Evelyn Lucy Cheesman, who collected plants along with many insects in 1933–1934, and the English traveller Arthur Hugh Batten Pooll in 1940. Of far greater importance, however, were the nearly 7,000 numbers collected by the New Zealander and former rubber planter in Malaya, Cedric Erroll Carr. Arriving in Papua at the end of 1934, he stayed a year and a half before his death from blackwater fever in Port Moresby in June 1936. Like those of Mrs Clemens, his very substantial collections have never been entirely worked over (van Royen 1980). As with Schlechter before him, he specialized in orchids but did not neglect other plants. He also left a diary covering much of his trip, which surely should be one of the more interesting sources for the Papua of the mid-1930s.

Some of these collections, especially those of Brass and a small portion of those of Carr, were indeed written up and published relatively quickly. But the collections of the 1930s all became available at a time of a move by researchers away from individual collection reports and towards a more consolidated approach to documentation along the lines of the *Beiträge zur Flora von Papuasien*, which from the 1920s had become more truly regional in scope, or the *Botanical Results of the Archbold Expeditions*.

These broader approaches to treatments of families and genera, in effect a partial return to the monographic tradition of the mid-19th century, were doubtless influenced by Engler's Berlin and especially its *opera magna* like the *Pflanzenfamilien* and *Pflanzenreich* (Lack 1987a, b). Given relatively close ties at this time between Germany and the Netherlands (Meyer 1977), and the influence of German models on Dutch intellectual life (Pyenson 1988), it is not surprising that a renewed interest in broader family and generic taxonomic treatments would develop among Dutch botanists. For Malesia the first such work was Hermann J. Lam's 1919 dissertation on Verbenaceae. Later, collections from all of New Guinea came to be incorporated into the Buitenzorg-based series of revisions *Contributions à l'étude de la flore des Indes Néerlandaises*, begun in 1923 at the *'s Lands Plantentuin* in Buitenzorg under its then-director, Willem M. Docters van Leeuwen (de Wit 1949, p. cxli) and a forerunner of the current *Flora Malesiana*, and into similar work elsewhere.

This submonographic approach, while scientifically sound and, in good hands, capable of definitive work, did at times overlook or downgrade the importance of more locally-oriented floristic studies and their influence on local perceptions of taxonomic research (Ng 1988). Moreover, effective prosecution of larger-scale research has tended to favour bigger institutions with substantial herbarium resources (Lack 1987a, p. 259). As we shall see, for Malesia these were, save for Buitenzorg and, to a lesser extent, Singapore, all in Europe and North America. Of these latter the best-founded was the Rijksherbarium at Leiden in the Netherlands. No Australian herbarium would have the strength or even mandate to contribute in this way until well after World War II.

F. Western New Guinea, 1875–1942: the rising Dutch presence

Before discussing the post-World War II period, we should look back at the history of botany in the western half of New Guinea, now the Indonesian province of Irian Jaya, and the background to the rise of a sustained Dutch interest in the study of the Papuasian flora.

The early 'flurry' of official Dutch activity subsided with the publication of *Reizen naar Nederlandsch Nieuw Guinea* by P. J. B. C. Robidé van der Aa (1879). Only a limited amount of botanical work was done by visitors in the 1880s and 1890s, mostly in the western peninsulas and islands. Otto Warburg, whom we have already mentioned, visited McCluer Gulf early in 1889 before proceeding (via Cooktown) to German New Guinea. The director of the *'s Lands Plantentuin*, Melchior Treub, stopped briefly in nearby Ati-ati Onin during a tour of the Moluccas in 1893. Finally, Anna Weber-van Bosse, a phycologist, collected algae at Ati-ati Onin and in the western islands such as Gébé, Misoöl and Waigeo while on board the *Siboga*

during that ship's year-long marine-biological and oceanological survey of the Indies in 1899–1900; her *Liste des algues du Siboga* (1913–1929, published in the reports of the expedition) and related papers are basic for the study of marine algae in Papuasia.

The *Siboga* voyage, however, was symbolic of a renewed concern for an effective Dutch presence in their 'outer possessions' in the face of increasing foreign interest. This concern was translated into effective policy under Indies Governors-General Willem Rooseboom (1899–1904) and Joannes B. van Heutsz (1904–1909). In New Guinea, development of the territories east of the 141st parallel, a desire to exercise greater control of the growing trade in bird-of-paradise plumes, and complaints from British New Guinea about raids by the Marind-Anim or Tugeri people in the south were among the factors which prompted the dispatch of naval patrols in 1901–1902 and establishment of a government station at Merauke (Thompson 1980). Other stations followed as lowland penetration and control proceeded.

These developments were soon followed by systematic exploration of the interior, still scarcely known east of the Bomberai peninsula. The most sustained series of expeditions took place from 1903 to 1922 — the longest such programme ever mounted in New Guinea — and again from 1936 to 1940, both periods of strong economic growth in the Indies as well as heightened official interest in the 'last carriage' (Souter 1964, p. 148).

In the period 1903–1915 Dutch efforts, supported by the metropolitan *Maatschappij ter Bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën* (Society for the Promotion of Scientific Research in the Netherlands Colonies, now the Treub Society; Jacobs 1984, pp. 150–152) and its Indies counterpart, the *Indisch Comite van Wetenschappelijk Onderzoek* (ICWO, or the Indies Committee for Scientific Research) as well as the government and other bodies, at first focussed on the Merauke area and lower river systems of the south and the Mamberamo and Humboldt Bay areas in the north. From 1907 to 1915 Dutch military units undertook general exploration of much of the rest of the lowlands, joined with the Germans in a survey of their common border, and made initial forays into the central cordillera as well as the Arfak Mountains. During this period the scientific organizations concentrated on three expeditions to the Orange (Jayawijaya) Range and one of its 'snow mountains' (now without snow!), Mt Wilhelmina (Pk Trikora). This peak, the highest in New Guinea save for Mt Carstensz (Pk Jaya) in the more westerly, present-day Sudirman Range, was finally ascended on the last of these, the Herderschee expedition, in February 1913. Botanically, the expedition was noteworthy in two ways: August Pulle, of Utrecht University, became the first Dutch professional botanist to participate on a New Guinea expedition; and he and Medical Officer Gerard Versteeg made the first significant collection of an alpine flora in western New Guinea (van Royen 1980).

Dutch activities were in this period augmented by several expeditions from other countries. The most important botanically were the second British expedition to Mt Carstensz in 1912–1913, on which Cecil Boden Kloss, then of Malaya, acted as naturalist; the German-Polish naturalist Max Moszkowski's exploration of the Mamberamo Basin during his unsuccessful 1910 attempt on the 'snow mountains' from the north; and the Angi Lakes (Arfak Mountains) expedition of the intrepid Lilian S. Gibbs in 1913–1914.

The First World War interrupted exploration in Dutch New Guinea as in the rest of Papuasia, but resumed sooner than in the non-Dutch territories. The attention of the ICWO and other sponsors now shifted to the northern side of the central mountains. In 1920–1922, during a brief period of optimism in which for a time western New Guinea enjoyed separate residency status (Souter 1964, p. 148), two successive expeditions penetrated these from the Meervlakte, the latter crossing the central highlands to Mt Wilhelmina. One of Pulle's students, Herman J. Lam, then at Buitenzorg, acted as botanist on the first of these. A fine sketch of the flora as seen by Lam in 1920 appears in that author's *Fragmenta Papuana* (Lam 1927–1929, 1945). Among his accomplishments was the ascent of Mt Doorman, at 3,580 m one of the highest peaks in the northern part of the central ranges and one with an unusual flora. Lam produced a survey of its 'alpine' plants in the 1920s but, partly due to changing approaches already mentioned, its full treatment had to await publication of a general alpine flora more than fifty years later (van Royen 1979–1983).

In 1922–1923, due to a rapidly deteriorating economic situation in the Indies, the Dutch presence in New Guinea was reduced and, with one exception, all official exploration stopped until the 1930s. The only significant contributions were to be from a few foreign expeditions and by the 1926 Netherlands-American (Stirling) Expedition, sponsored by the ICWO and the Smithsonian Institution, which continued the work of the 1920–1922 expeditions but broke new ground through its use of air transport (Sinclair 1978, pp. 14–17). On this expedition Docters van Leeuwen participated as botanist, making substantial collections.

The botanical results of this first exploration phase were, beginning in 1908, mainly published in *Nova Guinea*. This, a stately quarto series founded to receive expedition contributions in all areas, was issued at Leiden and supported by the Indies Committee, the Treub Society and the Dutch Colonial Ministry. Solid but not spectacular, they consisted largely of lavishly illustrated contributions on individual families by many botanists (among them several orchid papers by Joannes Jacobus Smith at Buitenzorg) but included some syntheses (e.g. the Sapotaceae, by H. J. Lam, published in 1931). From 1912, Dutch collections were also incorporated into the *Beiträge zur Flora von Papuasien* and from 1923 they likewise appeared in the Buitenzorg *Contributions*.

Some results of non-Dutch activities were also noteworthy. The major paper on Boden Kloss's collections, the already-mentioned *Report on the botany of the Wollaston expedition to Dutch New Guinea, 1912–13* (Ridley 1916), furnished the largest coverage of 'alpine' species since that of von Mueller 27 years before. Subsequent work has greatly enhanced but not substantially altered the picture of that flora presented in these two papers (van Royen 1980, p. 259). Gibbs began the serious study of vegetation ecology in montane New Guinea with her *Dutch North-west New Guinea* (Gibbs 1917).

In the 1930s, new pressures began to be felt in the Indies as the development of the Pacific Rim continued and Japan began to appear as a 'Great Power'. As a contemporary Dutch governor in the Moluccas, J. Tideman (in Klein 1935, p. 16) remarked in a report, 'to ignore this fact [the increase of economic activity in the Pacific] now when determining our policy in New Guinea would be to invite failure and worse.' The increasingly rapid development of the Australian territories, and the promise of the airplane, also could not be ignored. Moreover, there were signs that petroleum might be found. A *Nieuw-Guinea Comité* was formed, which supported renewed exploration efforts and promoted surveys and development of economic resources.

The 1936–1940 expeditions, along with surveys by the Indies Forest Service and other parties including those led by Zeno Salverda and Erik Lundquist, were to be productive for botany, if not more so, than the 1907–1913 period, yielding a second great flow of collections. The most important undertaking surely was the Indies-American Expedition of 1938–1939, which was led by Archbold who had, as we have seen, already made two visits to Papua. During its 11 months of operation his botanist Brass, along with his Dutch colleagues Ebertus Meijer-Drees and Christiaan Versteegh, collected some 6,000 numbers. Its most important discoveries were the Grand Valley of the Baliem and its 60,000 inhabitants, the last full species of bower bird, and the existence of *Nothofagus* forests. Brass described the latter in his botanical report (Brass 1941, pp. 336–7). Many more studies of Papuasian *Nothofagus* would follow after World War II and lead as well to new floristic analyses (Good 1960; van Balgooy 1976).

The botanical collections of the 1935–1941 period initially found their way into *Nova Guinea*, the last parts of the Berlin *Beiträge* and the Buitenzorg *Contributions*, and especially the *Botanical Results of the Archbold Expeditions*. They would continue to be a rich resource for floristic, taxonomic and other studies after the Second World War. One collection, however, was published separately: that of Ryozo Kanehira and Sumihiko Hatusima made in 1940 on their second New Guinea expedition (their first having been a brief visit to the Mandated Territory in 1937). This appeared serially in the Botanical Magazine (Tokyo) in the early 1940s (Kanehira et al. 1941–1943) but unfortunately was not completed. It proved to be the last collection so published, and with its considerable percentage of purported novelties subsequently shown to be synonyms nicely illustrates that the time truly had arrived for the synthetic approach being advocated, as we have seen, at Buitenzorg and elsewhere.

The *Beiträge* and Diels' paper of 1921, already referred to, were the first 20th-century contributions seriously to attempt syntheses of taxonomic and geographic data for Papuasia. But, increasingly, the study of the New Guinea flora was becoming integrated into work covering the whole of Malesia. The establishment of the *Contributions* had reflected this trend (cf. de Wit 1949; Jacobs 1984, pp. 30–31), as did the monographic work of Lam and other Pulle students like Dirk van Slooten, Benedict H. Danser and Cornelius G. G. J. van Steenis. All these men were members of the Buitenzorg Herbarium staff which, before 1933 and Lam's move to the directorship of the Rijksherbarium at Leiden, was, as already for several decades, the sole significant research group for the Indies flora. In plant geography further stimuli were provided by the publications of Merrill on the relationships of the flora of Papuasia with the Philippines, and van Steenis (1934–1936) on the Malesian mountain flora. The latter included a synopsis of plant genera centering at over 1,000 m in altitude.

In the mid-1930s Lam took a major step forward in the study of the New Guinea flora. Building on the foundations laid by Beccari, Mueller, Warburg, Lane-Poole, Lauterbach and others, he (Lam 1934, 1935) supplied vegetation maps of the whole of New Guinea and nearby islands — the first of their kind — and suggested in his reviews that botanical work could be furthered as much by consolidation of what materials already existed as by new collections and observations. He also suggested that botanical and geological evidence should be dealt with together, and that alternative theories of continental masses — permanency vs. drift — be considered fairly. References to all family treatments in the *Beiträge* and *Nova Guinea* as well as other significant works were given.

In the report I have already mentioned, Brass (1941) also supplied a new review of the vegetation, incorporating more recent findings, and proposed a modification of the zonation schemes of both van Steenis and Lane-Poole. It was now becoming recognized, as not so before 1900, that the montane flora of New Guinea was very rich and, moreover, that a goodly part of the island's endemism was secondary and geologically more recent than was the case in Borneo which Lam (1934) had used for comparison. More penetrating analyses of the flora and its relationships with neighbouring areas, as well as further vegetation zonation schemes (or rejections thereof), would follow after World War II.

By 1942 the density of plant collecting in western New Guinea, while still relatively low by comparison with Java or Malaya, had reached a level between those of the former German and British territories in New Guinea (van Steenis-Kruseman 1950, p. cx). The Dutch, and to a lesser extent Merrill's group in the United States, had, however, assumed leadership in the study of the taxonomy, floristics and phytogeography of Papuasia, with the former gaining the dominant position after 1950.

The Dutch leadership, which effectively continues, is, I believe, due to several interrelated factors. Firstly, there was their historical presence in the Indies. The Germans, even though their contribution to Papuasian botanical knowledge was substantial, were there for less than one-tenth that time; and American, Australian and British undertakings largely revolved around the work of interested individuals and/or particular needs. Secondly, from the late 19th century the Dutch were building up in Java the institutions which came to enjoy a high reputation in the pure and applied sciences (cf. Pyenson 1988). Including the *'s Lands Plantentuin*, much enlarged under Treub, they undoubtedly were a significant factor in the success of the *Siboga* expedition and later on surely contributed greatly to the relative speed with which the natural sciences, including botany, were advanced in western New Guinea as well as elsewhere in the East Indies.

Thirdly, there were those at Buitenzorg and elsewhere who looked ahead to a comprehensive Indies flora. This was most strongly advocated by van Steenis, who had joined the *'s Lands Plantentuin* staff in 1927, and his colleague Danser. The phytogeographically rather than politically delimited *Flora Malesiana* project — the inclusion of the non-Dutch territories (save for the Solomon Islands) being decisive for the future integration of most knowledge of the Papuasian flora — finally came into being in the late 1930s and, as we have noted, succeeded the *Contributions* (which, though good in themselves, were thought to be too much a sideline). Finally, personalities: in addition to the interest of Pulle, appointed professor at Utrecht from 1914, two successive directors of the Rijksherbarium in Leiden, Lam (from 1933 to 1962) and van Steenis (from 1962 to 1972) made New Guinea (and Malesian) research a priority. Lam obtained a working agreement with Buitenzorg, which was extended after the war by formation of the *Stichting Flora Malesiana* (Flora Malesiana Foundation). Interested support also came from Lourens G. M. Baas Becking, professor of general botany at Leiden and director of the *'s Lands Plantentuin* from 1938 to 1940 and 1945 to 1948.

The Dutch were fortunate in having *two* institutions which could serve as effective centres for *Flora Malesiana*: one metropolitan, one in Malesia. The large British institutions (and their satellites such as the Botanic Garden at Sibpur near Calcutta) dealt with the Malesian region as only one of numerous responsibilities. (Kew would, after World War II, become a significant secondary centre for the *Flora* project.) Among institutions elsewhere, those in Germany were facing changing circumstances (Lack 1987b; Timler & Zepernick 1987). In the United States only a few were seriously concerned with tropical systematics, these being largely oriented toward the Americas (save for the work of Merrill and his associates at New York and Harvard). As for Australia, the herbaria were, as we have seen, too poorly supported to undertake detailed taxonomic work on any but small (though important) parts of their own large flora. The *Flora Malesiana* project was thus, in the words of one of its early associates, Hendrik C. D. de Wit, well placed to 'contribute decisively towards a co-ordinated knowledge of the New Guinean plant world' (de Wit 1949, p. cxlix).

II. Institutions

A. World War II: the awakening

The Japanese invasion and occupation of Rabaul in January 1942 marks in every sense the start of the modern era in New Guinea and the Solomon Islands. The ensuing combat and associated activities engulfed nearly the whole of Papuasia, opening up the land and exposing most of its people to new sights, sounds, ways of life and ideas. The speed of the Japanese advance, the Battle of the Coral Sea, the war in the Solomons, the Kokoda campaign and Milne Bay drew world attention. Hundreds of thousands of combatants and others of many nationalities and professions brought a lasting new interest in the region.

Among the demands of any war are a knowledge of terrain and cover, field survival and — to the future benefit of botany in Papuasia — timber. Activities by Japanese scientists and others doubtless contributed to the success of their invasion, but to date we know relatively little of work in the field or their botanical information system. It is recorded, however, that Peekel in New Ireland owed his survival under the occupation to his reputation as a botanist (Sleumer in Peekel 1985, p. 3). (That he preserved his MS. flora, which finally appeared 40 years after the end of the war, must be regarded as miraculous.) American and Australian field intelligence research was organized at Melbourne in an Allied Geographical Section (AGS). Among its many publications was *Vegetation study of Eastern New Guinea* (Allied Geographical Section 1943), which in its use of extensive air photo coverage broke new ground: 'very little work had been done up to the commencement of the war in the use of air photos in tropical forests . . . the mixed rain forest was an almost untouched field' (Womersley & McAdam, 1957, pp. 30–31). General surveys of vegetation and plant life were also prepared for geographical handbooks produced both by the AGS and the British Naval Intelligence Division. In the United States, E. D. Merrill produced a field survival manual, *Emergency food plants and poisonous plants of the islands of the Pacific*, and J. Hugo Kraemer a timber manual, *Native woods for construction purposes in the Western Pacific Region*. Both were revised and republished after the war, respectively as *Plant life of the Pacific World* (Merrill 1945) and *Trees of the Western Pacific Region* (Kraemer 1951). Bibliographies, covering the whole of the Pacific theatre of war, were also produced, namely *An annotated bibliography of the Southwest Pacific and adjacent areas* (Allied Geographical Section, 4 vols.) and *Toa kyo-ei-ken sigen-kagaku bunken mokuroku* (Japanese Department of Education, 6 vols.); both include botanical coverage.

The war also brought progress in forest botany. The appearance of *Native woods* in 1943, though restricted to armed forces use until 1945, was, as its author noted in the 1951 edition, the first dendrological work for the Western Pacific to appear in the United States. He could have added Australia: while Lane-Poole's 1925 report was a step forward, it was not a manual nor was it systematically illustrated. As we have seen, forestry in the Australian territories had been on a small scale and surveys few. Indeed, it is likely that without World War II, the Dutch foresters in western New Guinea would soon have been well ahead in Papuasian forest botany (and in fact the Boswezen Nederlands Nieuw Guinea made considerable progress in the lowland forests after the war). Allied troops — and especially the CB's (Seabees) — in the Solomons, at Milne Bay, in Buna and from Salamaua to Madang must have relied on local knowledge or on American sources such as Kraemer's work for timber identification and use. They were surely also aided by Carl De Zeeuw, a former student at the State College of Forestry in Syracuse, New York, as well as others not yet recorded. The well-known Australian contribution to New Guinea forest botany belongs only to the later period of the war, when the main military objectives had shifted northward (Ryan 1972); we shall return to this later.

Many individual servicemen collected, making use of what must have been a precious opportunity. The Australians H. J. Root and N. A. Wakefield collected on their own, the former mainly in the Port Moresby

area. With respect to American servicemen, E. H. Walker (1945, 1946) has given overall reviews of their work, in which they were encouraged by a naval education officer, David F. Grether. However, without a formal mechanism for processing and publication collections and observations soon became widely scattered, as Walker himself noted. Some from Papuasia were only partially or not at all studied. Among the most useful were Levi T. Burcham's grass collections, later published (Burcham 1948), and especially the combined work, continued until 1946, of Grether and Warren H. ('Herb') Wagner on pteridophytes in the Admiralty Islands (Wagner & Grether 1948). Mainland collectors included John R. Reeder, who would also publish on grasses (Reeder 1948); later he specialized in that family.

B. The 'New Guinea Forces' (N.G.F.) collections

Besides forcing the defence of New Guinea and Australia, the war laid bare the limitations of earlier Australian policy towards the territories and the 'perfunctory operation' of responsible authorities, especially the then-Department of External Territories (Ryan 1972). Into this policy vacuum came what Ryan has termed a 'remarkable army unit', the Directorate of Research and Civil Affairs (DORCA), organized in 1942. With an expert body of members (which included the first postwar Administrator of the combined Territories, Col. J. Keith Murray) and much specialist advice, they recommended that over a broad range of social, cultural and political, as well as economic, activities a different, essentially more activist approach towards development was needed. Capital expenditure on a much larger scale would be called for, though always, however, with the hope of some greater economic return.

Among the fields singled out by DORCA was forestry. It should therefore not come as a surprise to suggest that in DORCA's planning lies the origins of the T.P.N.G. Department of Forests. But the work of DORCA, and its activist point of view, also influenced government decisions on the conduct of the war in New Guinea (Ryan 1972). I believe that as part of this admittedly controversial policy, which in any case would have made new demands for timber, there came in March 1944 the organization of two Forest Survey Companies as part of the Australian Army Engineers. These were placed under the command of James B. ('Jim') McAdam, who was one of the two foresters appointed to the Mandated Territory in 1938. Aware that the forest trees were still poorly known, and with an eye to the future, McAdam arranged for collections of herbarium material and timber and wood samples to be made.

The work was initiated at Lae by Cyril White, along with H. E. Dadswell from CSIRO's Forest Products Division in Melbourne, and carried forward by several interested forester-servicemen in a large number of areas under the general supervision of Lindsay Smith from the Queensland Herbarium (Womersley 1953). White and Smith gave botanical and dendrological lectures which were later revised by E. E. 'Ted' Henty and published in 1961. The collections, numbered in a series called 'New Guinea Forces' (N.G.F.), were sent to Brisbane for study but, a set of these, left in Lae at the close of the war, would form the nucleus of the botanical service envisioned by McAdam. White returned to the region in 1945 to assist with similar work in the Solomon Islands (Walker 1948; White 1950) and, after the war, gave much assistance to what eventually became the Division of Botany in the Papua and New Guinea Department of Forests before his untimely death in 1950.

C. Postwar development in P.N.G. and the Division of Botany

In 1945 a provisional Papua-New Guinea administration came into being under the leadership of J. K. Murray. In the following year, doubtless after some debate (Michener 1951), Australia was awarded trusteeship over the former Mandated Territory of New Guinea. The activism of DORCA and the 1944–1945 Australian campaign had made their point, and the new arrangements ensured that Papua, in 1942 even less developed than was the Mandated Territory, would benefit. More permanent arrangements, including establishment of a Territories public service, came into effect in 1949 with passage of the Papua and New Guinea Act.

In an effort to summarize current knowledge and stimulate development, the Australian Commonwealth soon after produced *The resources of the Territory of Papua and New Guinea*, which included an atlas (Australia, Department of Regional Development 1951). Expansion of the government departments most concerned with the economy, including Agriculture, Stock and Fisheries, Forests, and Lands, Surveys and Mines, provided some scope for the growth of government science activity, and in 1949 interested scientists and others formed the Papua and New Guinea Scientific Society (Salter-Duke 1984).

The next logical step would have been the establishment of one or more government scientific centres. Such centres already existed in many dependent territories, or would be developed in the future. Australia itself, in CSIRO, had a model. But relative proximity to the metropolitan country, the evident lack of a science policy, the strength of public service traditions (cf. Sir David Rivett in Oliphant 1951, p. 162), the growth of bureaucratic rivalries (Frodin 1988; P. F. Stevens, pers. comm.), regressive tendencies (Hasluck 1976) and a seeming absence of vision prevented formation of such a centre — if, indeed, the idea was ever contemplated. Accordingly, until establishment of the universities in the 1960s the sciences in New Guinea, including botany, were almost entirely the province of government departments.

Given these factors, what was accomplished in the sciences in the remaining years of Australian administration depended, in my opinion, very much on individuals. With respect to botany, Henty (unpubl.) believed that, in addition to the general commitment to greater development expenditure, the appointment of McAdam as acting secretary and later as the first Director of Forests, was a prime factor in the creation of a distinct botanical service linked with a botanical garden.

The office of the Forest Botanist was accordingly established at Lae in 1946. (It became the Division of Botany in 1954 and in 1984 was combined with other forest research activities as the Division of Botany and Forest Management Research. It is now, or will be,

part of a new Forest Research Institute.[1]) John Womersley (1920–1985) was appointed in August 1946 and began work in Lae early in 1947. He was the sole professional employee until 1953, when a second post, for a botanist/ecologist, was created and Alex Floyd appointed. The first Papua New Guineans who would become well known in their own right joined around 1955: Nima Kokori and Michael Galore. Shortly afterwards, Floyd resigned and in mid-1957 was succeeded by Kevin J. White, a Queensland forester who, however, moved two years later into an administrative career within the Department (ultimately becoming. until his retirement in 1977, First Assistant Director for Research and Training which included overall responsibility for the Division). E. E. ('Ted') Henty also joined the Division in 1957, and would remain for 27 years until his retirement at the end of 1984.

In the 1960s, more positions, in all grades, were created as additional funds became available. By the end of the decade the establishment included, besides Womersley, six professional staff — 4–5 in the Herbarium and 1–2 in the Gardens, the latter including a curatorship (first instituted in 1963). The larger staff made possible not only a more diversified programme of work (and publication) but also more opportunities for Papua New Guineans.

Among the latter were several field assistants, the names of some of whom would become well known: Yakas Lelean, who joined in 1964; Paul Katik, who joined in 1966, and Artis Vinas, on the staff from 1971–1979. Katik in particular developed a superb knowledge of plants, much as had the late Indonesian *mantri* at Bogor, Nedi. They sometimes collected on their own but more frequently were on parties headed by professional staff, including (in 1965–1966) the writer.

Non-national staff on average stayed only a few years. Among longer incumbents, besides Womersley and Henty, were Mark Coode (1966–1972) and James R. ('Jim') Croft (1973–1987). But perhaps the most colourful — and controversial — was 'Plaua Missis', Mrs Andree Millar (1916-). Appointed in 1956 as Gardens Assistant, she was Acting Curator for more than two years before her resignation early in 1971 and move to Port Morseby. Through her work in general gardening, shows, and especially orchids, she became better known among the Territory public than any other botanist. Indeed, one historian has claimed that 'she established a more productive relationship with the environment than almost any other Australian' (Nelson 1982, p. 106). Her book on orchids (Millar 1978), if somewhat flawed, remains the best lay introduction to Papuasia's rich orchid life. But, for a decade and a half, life in the Division revolved around the rivalry between her and Womersley.

The Divisional staff after 1960 also included illustrators as its publications programme accelerated. The first, Damaris Pierce, was appointed in 1964. Later, at different times, Terry Nolan, Faye Owner, Taikika Iwagu and Semeri Hitignue — the last two Papua New Guineans — were staff illustrators. Between them they have produced nearly 2,000 plant drawings, many still unpublished.

1 Opened on 8 April 1989

The goals of the Division when organized as such were: 1) maintenance of a herbarium and botanic garden; 2) study of the vegetation of New Guinea, especially the eastern section; 3) provision of an identification service and advice; and 4) planting of the garden with native and exotic ornamental and useful plants and trees, and the supply of [nursery] stock to the public (Henty, unpubl.) In 1957 the Division assumed effective responsibility for government botanical services as well as collections in all plant groups save fungi (all of which were transferred to the Department of Agriculture, Stock and Fisheries in Port Moresby). Perhaps fulfilling McAdam's vision, it thus became one of the many 'gardens for science and pleasure' (Hepper 1982) which, inspired by Kew, had been established almost throughout the British dominions and colonies, including Australia (cf. Brockway 1979).

The early years were devoted to rescue of the abandoned set of duplicates — some 2,000 numbers — of the wartime Forces collections as a basis for establishment of a workable herbarium, and to building the botanical garden. By 1949 the latter would have 57 hectares (with the added responsibility of the adjacent war cemetery). An old residence on the property, close to the present Herbarium which replaced it in 1965, was used as a headquarters with two nearby buildings serving for garden operations.

The N.G.F. series was continued by Womersley and his staff as the official institutional series. Beginning at about 2,600, numbers reached the 12,000s by 1960 but then began to accumulate more rapidly as staff and activities further increased. In 1965–1966 the range was 25,000–32,000; and around 1970, when numbers reached 50,000, the designation was changed to LAE but without breaking the numeration. At present the 80,000s have been reached but growth since 1975, and even more so in the 1980s, has slowed (cf. Prance & Campbell 1989, p. 525).

In the first decade and a half collections were made by a number of foresters in the Department as well as by the botanical staff, and a good basic record of big forest trees was built up. By the early 1960s, however, there was a shift to the flora as a whole, with most contributions to the series coming from the Division of Botany and the Forestry School (later College) at Bulolo. The latter made many collections of big trees as well as of the flora in the upper Watut basin south of Lae and elsewhere. The Herbarium has also acquired many specimens from other government officers and private residents as well as from the large number of visiting expeditions and individual scientists, in conformity with customs regulations in force from 1951. It also has managed to obtain, through exchange, duplicates of some of the pre-World War II collections. Sets of the BW-series from western New Guinea, collected between 1955 and 1962, as well as collections from other Dutch expeditions in that territory are also available, along with a set each of the BSIP and RSS numbers from the Solomon Islands. A small library, as well as collections of photographs and drawings, were also built up.

Publications appeared only slowly in the first decades after the Division was established. The first major work, still cited, was *The forests and forest conditions in the Territories of Papua and New Guinea* by

Womersley and McAdam (1957), prepared for a British Commonwealth Forestry Conference held in that year in Australia. In 1961 the White botanical lectures were published as an aid to students at the new Forestry School at Bulolo and two years later there appeared *The vegetation of the island of New Guinea* by Pieter van Royen (van Royen 1963), originally prepared in 1961 for the Tenth Pacific Science Congress in Honolulu.

Pressures began to mount, however, for more readily useable manuals and other floristic works, and from 1964 publications began appearing more rapidly. We mention here *Manual of the forest trees of Papua and New Guinea* (van Royen *et al.* 1964–1969), in nine parts, with one revised, but never completed and now partly outdated; an irregular series of *Botany Bulletins* (1969-); and, finally, the ambitious *Handbooks of the Flora of Papua New Guinea* (Womersley *et al.* 1978-), planning for which began in 1970 and of which to date two volumes have been published by Melbourne University Press. Others will be discussed below.

Staff would also contribute to other works, and would prepare separate research papers; but with relatively few exceptions systematic studies in the larger seed plant families, and still more so the cryptogams and non-pathogenic fungi, have continued to be prosecuted by botanists in more developed countries. Even more than in Australia itself, systematic botanists in New Guinea, or in Australia and working on the Papuasian flora, have been dependent, and are likely long to remain so, on widely scattered, distant outside herbaria. The destruction of most material from former German New Guinea (save for the pteridophytes) in Berlin in 1943 will remain a great handicap. Fortunately, the herbarium in Lae is, at more than 250,000 specimens mostly from Papuasia, of a size suitable for research; those in the Indonesian province of Irian Jaya and in the Solomon Islands, were, like other herbaria in Papua New Guinea, organized as, and have remained, comparatively small reference collections.

Yet while some revisionary work was done at Lae, particularly in the late 1960s and early 1970s, and from time to time (as qualified personnel were available) studies of vegetation were made, it was the Procrustean tasks of collecting, identifying, specimen curation, the making of illustrations, correspondence, organisation of field work, hosting of visitors, and related duties which formed a large part of daily activities. Development of the Garden also absorbed a particularly large share of attention up to the 1960s, and remained important as that part of the Division's activities most visible to the public, especially with its central location in the city of Lae.

The Division has accounted for the largest single share of botanical exploration in Papuasia since 1945. I think it fair to credit John Womersley for much of this achievement, whatever criticism may also be merited — including the development of a certain 'distance' from other government activities. However, the last time I ever saw him (in 1984), he said to me, 'Jim McAdam's death [in 1959] was a great loss.' In spite of the tone of 'official' accounts, such as that by Angus (1972), the Forest Service was afterwards not the same, and perhaps could not have remained so: government policy changes, especially those resulting from the 1962 United Nations Visiting Mission (Souter 1964) and the World Bank study, *The Economic Development of the Territory of Papua and New Guinea* (International Bank for Reconstruction and Development 1965) led, among other things, to an emphasis on forest development and production. The changed atmosphere is well illustrated by the promotional booklet *New Horizons* (Department of Forests 1973), as well as in the planning for a forestry degree course (Howie-Willis 1980, pp. 166–176). Botanical research moreover failed as such to become effectively incorporated into national goals, in part due to the already-mentioned 'distance' of the Division of Botany (Stevens 1989, p. 131). Tidy public service minds began to see the Division as an anomaly, with consequences to which we shall return.

It is in the face of such changes, which especially from the 1960s were quite rapid, that the already-noted lack of interest in some form of integration of government research resources becomes apparent (Frodin 1988). Most scientific work, including the development of natural science collections, had more or less followed departmental priorities, and physically was widely scattered. In particular there was no one body which would be able to carry out integrated natural science research in the manner of CSIRO's LRRS. Had there been, perhaps some of the problems surrounding the JANT integrated timber development in the Gogol Basin near Madang (Webb 1977) would have been lessened. The lack of suitable statutory research institutes also exacerbated the problem of long-term support of living resources, such as the Papua New Guinea Biological Foundation banana collection (King & Bull 1984). The present National Museum and Art Gallery, re-established in 1954 (Frodin 1988), has been primarily concerned with cultural history. What long-term collaborative research and service arrangements with counterparts in Australia (or elsewhere) existed was ad hoc, often based on personal relationships. Consultancy was usually on a case-by-case basis.

D. Other botanical centres in Papuasia

Internal development in Papua New Guinea, especially in education and privately sponsored research, but also in local government and politics, was also creating new needs and desires, some not foreseen in earlier years. Moves for additional botanical centres emerged, partly in reaction to the Division of Botany, but mainly to support specialized areas of applied research and, later, higher education and basic biological and ecological studies. More parks and botanical gardens were established. Interest in, and concern for, the New Guinea flora was becoming — as Womersley would not easily admit — too large and diversified for monopoly by a single organization.

The first two of these additional centres were the Plant Pathology Branch of the Department of Agriculture, Stock and Fisheries (now the Department of Agriculture and Livestock) at Port Moresby, and the Forest Research Station at Bulolo. In Port Moresby, a considerable herbarium of thallophytes, mainly pathogenic microfungi, was built up from about 1955 under the direction of Dorothy Shaw (to which, in 1957, were added all fungal collections from Lae), and a compendium of pathogens published (Shaw 1963).

The Bulolo centre was established shortly afterwards in connection with reafforestation activities in the Watut Valley and two collections came into being. A herbarium of forest trees was started by a forest officer and dendrologist, the Czech emigre Jacoslav J. ('Joe') Havel, which went around 1962 to the nearby Forestry School (later College) and has been added to, though on a relatively small scale, since. As at Lae, the professional staff had field assistants who accompanied them, often as part of class field trips, or worked on their own. The best-known is Aubeta Kairo, who began work at the School in the early 1960s and was still active by the mid-1980s. The second collection at Bulolo, which remained at the Research Station, comprises fungi associated with forests and wood, and is strong on polypores. It has no counterpart elsewhere in the country.

The College staff have rather actively contributed to the literature, particularly in student texts and manuals — arguably more productively so than at Lae. Havel, for a time Principal (until 1965, when he returned to Western Australia), produced a dendrological handbook to major timber species, *Forest Botany* (Havel 1970–1975), which incorporated a fine essay, 'Teaching tropical forest botany' [originally published in *Unasylva* 19 (1965)]. This work was later revised and expanded by the New Zealander Robert J. Johns as *Common forest trees of Papua New Guinea* (Johns 1976–1978). Johns also initiated another series, *A students' guide to the monocotyledons of Papua New Guinea* (Johns 1981), of which at this writing three additional parts have appeared (Johns & Hay 1984), including one (by Lord Alastair Hay) on the palms — the first modern survey for New Guinea of this important family — and another (by Neville H. S. Howcroft, of the Research Station) on orchids. Havel, Johns and other college staff teaching botany, ecology and dendrology also contributed technical papers. Barry Conn, a staff member in the mid-1970s after service at Lae, produced an introductory botany text (Conn 1979) which drew as far as possible from local sources. Howcroft wrote a number of semi-technical articles on orchids, mainly for the *Orchadian* in Australia.

At the universities, founded in 1965 at Port Moresby respectively as the University of Papua and New Guinea (UPNG) and the Institute of Higher Technical Education (the latter soon after moving to Lae and around 1975 becoming the University of Technology), herbaria were also established. At UPNG, collecting began in 1969 and the herbarium, when effectively established within the Department of Biology, became the only general herbarium in the national capital, providing services to the teaching staff, students, government and the public. It directed part of its attention to the interesting flora of the Port Moresby region, where a strongly seasonal climate prevails. In an attempt to increase knowledge of this flora work was initiated in the mid-1970s on a regional flora project. This was to be based on all known records — not an easy task, as the vast majority by then were widely scattered elsewhere, the area having one of the longest histories of collecting in New Guinea (Frodin 1981). A handbook to mangroves was also produced (Frodin *et al.* 1975; Frodin & Leach 1982), as well as a manual of aquatic macrophytes (Leach & Osborne 1985). Individual research projects were also pursued. After a serious fire, the Herbarium was re-housed in a new university building complex, the Natural Sciences Resource Centre, in 1984 (Lambley & Frodin 1987).

A teaching herbarium was also established at the University of Technology when its Department of Forestry (established in 1975) took over full responsibility for the national undergraduate forestry degree course in 1980. Dubbed the Leonard J. Brass Memorial Herbarium, it has served as a base for botanical and ecological activities by Johns, who joined the University in 1979, and his associates: forest ecology (especially of dipterocarps; much work, however, remains unpublished), dynamics (the development for New Guinea of the idea of 'unstable' forests having been one of Johns's special interests), and the continued preparation of student manuals — a necessity in Papua New Guinea, where much literature is too technical.

Collections have also been made at biological research stations, notably the Wau Ecology Institute, and most recently the Christensen Research Institute, and by private individuals, including missionaries. Among the latter are the Rev. Norman Cruttwell and Brother O. William Borrell. Borrell has prepared a flora of Kairiru, a high off-shore island near Wewak.

Elsewhere in Papuasia locally-based botanical work was largely connected with a systematic forest survey. The already-mentioned *Boswezen Nederlands Nieuw Guinea* was started in Hollandia (now Jayapura) in 1950 and a herbarium established in 1952 (moved to Manokwari in 1958). Collections were made in a series labelled 'Boswezen', abbreviated to BW. These were largely from lower elevations and, to a greater degree than in Papua and New Guinea, comprised almost exclusively tree species (though towards the end of Dutch rule they became broader in scope). By October 1962 almost 15,000 numbers had been collected. In the Solomon Islands a forestry survey was mounted shortly after the war (Walker 1948; White 1950) but the resulting BSIP-collections were relatively few in number and not added to until survey work was revived on a larger scale in the early 1960s with funds from the Overseas Development Administration. As part of this effort collecting in the BSIP-series was resumed by Timothy Whitmore, as forest botanist, together with a number of local assistants and associates, and by 1970 had reached some 17,000 numbers. As in western New Guinea these were heavily oriented towards tree species, though perhaps less narrowly so. In 1965 a considerable boost came with the work of the Royal Society expedition, noted below. However, budget restrictions have since largely curtailed further collecting and for several years the herbarium in Honiara has been relatively inactive. A forest tree guide has been published (Whitmore 1966).

E. Metropolitan visitors

Local institutions, while making an impressive showing, were, however, not alone. Institutions and individuals from Australia and other countries also made large contributions, sometimes in areas of botany not well developed locally. I now consider these 'metropolitan' activities.

The most substantial Australian contributions came from Federal institutions, notably the former Land

Research and Regional Survey Division (LRRS) of CSIRO, the Australian National University, and, at a later date, the National Botanic Garden in Canberra. The LRRS was first into the field. This unit came into being after World War II when it was recognized politically that the potential of many parts of Australia, particularly in the north, was poorly known. Their speciality was an integrated geographical approach to land evaluation in selected areas, one which usually included plant collecting and vegetation survey and sometimes forest assessment. Field work in New Guinea began in 1953 and in the following sixteen years fourteen surveys were conducted, covering perhaps 40–50% of the land area of the two Territories. For eastern New Guinea, the surveys were novel in that they were systematic, and bore a partial resemblance to the work of some of the German expeditions. Several botanists and ecologists participated, including Ruurd D. Hoogland, who also created and built up a botanical section (now part of the Australian National Herbarium in CSIRO) to house the resulting collections. Chapters on the vegetation and forest resources were prepared for incorporation into the land reports, the first of which appeared in definitive form only in 1964 and the last in 1976. Many separate botanical and ecological papers appeared in a variety of journals, including (from 1973) *Contributions from the Herbarium Australiense* and its successor *Brunonia* (now *Australian Systematic Botany*), but no consolidated 'botanical results' were published.

At the end of the 1960s, with self-determination approaching sooner than had been envisioned fifteen or twenty years before, the New Guinea surveys were largely wound down and the Division given a five-year mandate to prepare consolidated reports. Three maps (including one for vegetation) and four monographs [including *New Guinea Vegetation*, edited by Kees Paijmans (Paijmans 1976)] have so far appeared. The value of the three contributions, respectively by Max van Balgooy of Leiden (on plant geography), Paijmans, and Jocelyn Powell (on ethnobotany) of Sydney, in the vegetation volume is attested by their frequent citation by other researchers. Cooperative work between the Papua New Guinea Government and LRRS's successor body, the Division of Water and Land Resources, was from 1980 revived with particular reference to subsistence agriculture (Potter 1984, p. 21), but the more limited scope of these studies has meant that much of the legacy built up over twenty years has not been effectively utilized or added to.

One important collection made under CSIRO auspices was written up in full. This was the phytochemical survey in 1961–1964 by Thomas Hartley from the United States, financed partly by a U.S. pharmaceutical company. Along with some 3,700 plant collections, samples were tested for active properties, both in New Guinea and in CSIRO laboratories in Melbourne. A check-list, including botanical names and activity codes, subsequently appeared (Hartley *et al.* 1973), a major addition to the more limited results of Leonard Webb's 1951 survey (Webb 1955). After Hartley's departure from New Guinea, funds continued to be made available over a number of years for collection of larger samples of particular species as required by the sponsors. [As this is written sampling has been resumed as part of an international programme sponsored by the National Cancer Institute in the United States.]

The Australian National University (ANU) formed its Research School of Pacific Studies in 1951. Its Department of Geography was later expanded to include biogeography and geomorphology and from around 1959 Donald Walker and his students and associates built up the largest Australian group in the field, achieving separate departmental status in 1970. They became the effective founders of modern vegetation science and Quaternary studies in New Guinea, moving away from mere tabulation and description as had been hitherto usual. Developments in the earth sciences had also renewed interest in biogeography. At the same time also there was a developing concern with ethnobiology. In New Guinea research fields initially focussed on montane and subalpine vegetation and the record of its past as preserved in lakes and swamps. Later, interest was expanded to include lower elevations. However, since the late 1970s field work has been greatly reduced, with Geoffrey S. Hope the only one continuing into the 1980s with study sites in the Wharton Range and in Irian Jaya.

Several theses were written and analytical and synthesis papers have appeared over the last 25 years, but much remains unpublished. As well as the work of Paijmans already referred to, mention should here be made of *Bridge and barrier* (Walker 1972),

The equatorial rain forest (Flenley 1979), which covers the whole tropics, the first volume of *The alpine flora of New Guinea* (van Royen 1980), and papers by Walker and Hope, Jim Smith, and others in *Biogeography and ecology of New Guinea* (Gressitt 1982), as well as a general survey of montane and subalpine forests (Grubb & Stevens 1985).

As with CSIRO, the work of ANU staff and students resulted in a substantial body of collections, which were deposited in the CSIRO LRRS herbarium. The ANU-series, however, also contains material from Australia and elsewhere. Other workers have cited some of these specimens in their descriptions of novelties, revisions and monographs.

I turn now to the work of other visitors to New Guinea, including that in continuation of programmes started before World War II. Since 1914, no major *general* expeditions had been mounted in eastern New Guinea, unless the 1921 economic 'exploring expedition' is counted. Although Behrmann (1924) had, properly, lamented the near-absence of new exploration and the reduction in scientific work in the former German territory, changing methods and fashions in research, increasing specialisation in the sciences, costs, the appearance of the airplane (and, later, the helicopter), easier access for individuals, a surge of new development in many areas after 1925, and the rise of local institutions, reduced or eliminated the need for the often overly massive general expedition. Biological exploration became separate, and geographical exploration would be more closely linked to administrative or, in the Mandated Territory, even commercial penetration (Firth 1982). In western New Guinea general expeditions continued for a longer time, but save for the already-mentioned Stirling Expedition in 1926 and, in some respects, the Star Mountains Expedition of 1959 — which figuratively eliminated 'the last white patch on the map'

(Brongersma & Venema 1962, p. 18) — they were not on the scale of the expeditions of the 1903–1922 period.

About the only large biological survey expeditions were those conducted by the Archbold Expeditions foundation in New York, previously mentioned. After a trip to the Cape York Peninsula in 1948, there were four further New Guinea expeditions, in 1953, 1956, 1959 and 1964. Brass was botanist of the first three of these, and Hoogland on the last. As before the war, areas were systematically selected and sampled. The botanical collections — handled in all by four different institutions — were not, however, written up in the earlier manner, although botanical summaries continued to appear in the expedition reports.

As for American work on the Papuasian flora, with Merrill's retirement from the directorship of the Arnold Arboretum research interests at Harvard largely moved elsewhere, although Lily Perry, Thomas Hartley and Peter Stevens successively acted as curators for Papuasian botany until the 1970s and its *Journal* continued to carry contributions. Not again, however, has there been in the United States an active institutional centre comparable to those which have concentrated on different parts of Middle and South America since the 1880s. What long-term programmes of support for work in New Guinea currently exist are mainly in Europe and Japan.

Ship-borne expeditions became largely concerned with oceanology and marine biology. I shall mention two, however, which did considerable land work: the Danish 'Noona Dan' expedition of 1961–1962, which while in Papua New Guinea worked in some rarely visited areas (but whose collections contained few duplicates); and the British 'Operation Drake' in 1979, whose major interest was beta-adventure but which did some serious work in the forest canopy using walkways - rarely if ever attempted before in New Guinea. The latter's experiences are recounted by Mitchell (1986).

In contrast to such general expeditions the growth of infrastructure in New Guinea and the formation of the Division of Botany, as well as the trend towards greater specialization, promoted the mounting of more botanical expeditions. Operations would usually be carefully focussed (cf. Lam 1960, 1961), and liaison effected with local botanists. Dutch expeditions were the most numerous, extending from 1954 to 1975 and beyond, and sometimes prolonged (van Royen in 1954–1955 was nearly a year in the field). From 1963, reflecting the priorities of van Steenis (now director of the Rijksherbarium in Leiden) the high mountain flora received particular attention. All of them were wholly or partly sponsored through his institution, save one by van Royen in 1976 organized through the Bernice P. Bishop Museum in Honolulu — and which provided a partial basis for his *Alpine Flora of New Guinea* (van Royen 1979–1983). The mid-1960s saw the resumption of British expeditions, beginning with that in 1964–1965 by Clive Jermy and others which specialized in pteridophytes and other cryptogams, and followed by two from Kew, one in 1969 and one in 1975. In 1965 there took place the Royal Society Solomon Islands expedition (Corner *et al.* 1969). There were two student expeditions from Oxford in the 1980s. The longest was the nine-month study, in 1970–1971, by Peter Grubb and Peter Edwards, of the structure, composition, dynamics and functioning of a montane rain forest near Goroka. This resulted in several papers in the *Journal of Ecology* and, ultimately, a monograph (Grubb & Stevens 1985). From the late 1960s Japanese were again active, and have conducted five expeditions: four from the National Science Museum in Tokyo (1964–1975), and one, in 1985, from Osaka City University. Those from Tokyo paid particular attention to cryptogams and fungi, including those in the highlands (cf. Kobayasi 1971).

I cannot mention separately all the many individuals who have come to New Guinea to prosecute research projects and collecting. The diversification of botanical work and changing trends of scientific enquiry have greatly influenced what individuals do during their stay. There has been a marked rise in such visits, beginning in the 1960s. Researchers have represented a great many organisations, or come on their own. Their presence has introduced an element of complexity: while activities have been made more possible by greater ease of travel and improved infrastructure they also have introduced an element of local concern. A goodly part of the outsiders' work has been in the areas of vegetation science, ecology and prehistory, which has involved extended stays in study areas.

F. 1975 and beyond: changing scenes

Papua New Guinea gained internal self-government in 1973 and full independence within the Commonwealth of Nations in 1975. The Solomon Islands were granted independence from the United Kingdom in 1978. With these political developments came policy and other changes which, along with economic factors, have had a considerable impact on the development of the botanical sciences. The appearance of *Biogeography and ecology of New Guinea* (Gressitt 1982), which came at a time of major world recession as well as changes in the public perception of science, may reasonably be taken as marking the end of this account as well as of the post-war era.

John Womersley retired as Chief of the Division of Botany in 1975 after 29 years and, not being offered re-employment, returned to Australia where he entered into other pursuits until his death in 1985. Expatriate staff at the Lae Herbarium (which in 1974 became the Papua New Guinea National Herbarium), still numbering 11 in the early 1970s, quickly fell and by the early 1980s only three remained. Productivity also declined, and maintenance of the collections became an increasing problem. In 1983 there was a budgetary crisis, resolved only through local and overseas protest. While the immediate causes were planning and budgeting errors, the incident suggests that not only was the past 'isolation' on the part of the Division responsible but also that botany had yet to win an effective place in national life (cf. Stevens 1989).

Broader issues, though, also acquire significance. In many developing countries, Papua New Guinea among them, basic research and documentation, in spite of apparent support for the sciences through education, has not fared well (Yeboah-Amankwah 1984, p. 5; Šlaus 1987, pp. 16–17). Research and development activity in the new country moreover was, through inheritance, not well organized and generally

lacked an effective institutional-cum-political base. It is thus to be regretted that at a major meeting, the 1984 Waigani Seminar 'The role of science and technology in the development of Papua New Guinea' (Morton 1984), these issues were not squarely addressed although many areas, including teaching, were examined in some depth.

Relatively few Papua New Guineans have entered botany, partly because of lack of encouragement but also because opportunities in other areas have been more attractive. Only Osia Gideon and Simon Saulei (at least in systematics and vegetation science) have so far published in international journals. Many others have been involved, though largely in support roles. Papua New Guinean scientists generally are too few (Pernetta & Hill 1984), a situation I believe has been aggravated also by the present institutional science structure, in large part inherited from before independence. Without a good career structure for research and a sense of security further professional development will be hampered. The establishment of the Forest Research Institute at Lae represents a step in the right direction in this respect.

One step forward, admittedly small, was the creation in 1975 of a national botanical society. With botany and related fields being pursued in more centres, there was felt a need to supply a forum for professional exchange. The existing Papua New Guinea Scientific Society (which was to cease activity in 1979) was seen as inappropriate and accordingly the Papua New Guinea Botanical Society was formed. It has continued to the present as a 'collaborative': no constitution, no dues, etc., a policy deemed best given local circumstances. Meetings in recent years have been annual, in different centres, and have provided a forum for young Papua New Guinean professionals and subprofessionals, as well as others interested in botany, agriculture, forestry and related areas. But under present circumstances the Society, a confederation, can do little to improve the status of the field, or indeed the sciences, in Papua New Guinea.

It remains to be seen how long an effective publication programme can continue. Several key works did appear in the ten years after independence. The chief of these is the Lae-based project *Handbooks of the Flora of Papua New Guinea*, which I have previously referred to. Established in the early 1970s, this was intended to produce a series of volumes eventually to cover the whole vascular flora of Papuasia, with full treatment of species occurring in Papua New Guinea. By my estimate, some 15,000 species would have to be covered. The first volume appeared in 1978, the second in 1982; so far 25 families (two only in part) and 361 species have been documented. A third volume was ready for press in 1984. I feel that the future of this ambitious flora project is most uncertain.

The period since 1975, however, has been notable for regional revisions and/or handbooks for several large families as well as partial floras. Among the former are treatments of Gramineae (by Ted Henty) and Leguminosae (by Bernard Verdcourt at Kew), both published as *Botany Bulletins*; Euphorbiaceae (by the late Ken Airy Shaw, also at Kew), in *Kew Bulletin, Additional Series*; and Solanaceae (by David Symon, formerly at the Waite Institute in South Australia), in *Journal of the Adelaide Botanic Garden*. These joined Josephine Koster's series on the Compositae in *Nova Guinea, Botany* and *Blumea*. An English edition of Schlechter's *Die Orchidaceen von Deutsch-Neu-Guinea* appeared in Australia in 1982, with the formerly separate plates (published in 1928) incorporated. Recent new or reprinted regional floras/check-lists include Schumann & Lauterbach's flora (by the German publisher Cramer); check-lists for Mt Wilhelm (Johns & Stevens 1971, now out of date), Bougainville (Foreman 1972), and the upper Watut basin in Morobe Province (Streimann 1983); and the translation by Ted Henty of the MS. *Illustrierte Flora des Bismarckarchipels für Naturfreunde*, Father Peekel's legacy of nearly 40 years of work (Peekel 1985). For habitat-related plant groups, two key works have appeared in the last decade: *The alpine flora of New Guinea* (van Royen 1979–1983) and *Freshwater plants of Papua New Guinea* (Leach and Osborne 1985).

We have already mentioned *Biogeography and ecology of New Guinea* (Gressitt 1982), to its credit a truly international effort representing most 'interests'. Although not covering all aspects, the several botanical papers therein provide a fair overview of our present state of knowledge.

All this might suggest that the 'consolidation' phase (van Royen 1980, p. 297), the same as what may also be called the *beta* stage and representing the step from level 5 up to level 4 or even level 3 in Jaeger's map (cf. Frodin 1984, p. 20) is close to fulfillment; but such is in fact far from the case. With some good reason publication of collection catalogues has given way to preparation of revisions, and these latter properly seen as having a wider geographic scope. The work of some individuals and institutes has been guided for four decades by the *Flora Malesiana* project, now about 20% complete at species level (cf. van Steenis 1979; Prance & Campbell 1988). A good portion of the big trees is relatively well known. However, as noted, few have so far been covered in the *Handbooks*. Other current knowledge of the flora remains quite scattered. Many seed plant families, or parts thereof, are for the region scarcely documented in modern terms, with available information sometimes very old and often not helpful. Although in eastern New Guinea the density of collections per 100 square kilometres is now between 40 and 50 — not high but not *really* low — different kinds of plants have *not* been equally well collected (Stevens, pers. comm.), and there are some localities which have been too frequently sampled at the expense of others. Indices of collecting density are at best crude measures. Some research has unfortunately not been published, including a number of *Handbooks* treatments. Such circumstances make it difficult to obtain a good idea of the distribution, abundance and dynamics of most species and hence to provide satisfactory assessments of their conservation status.

Lack of knowledge among cryptogams and fungi is even greater. Despite some revisions, and a start on a students' manual (Johns 1979–1981), much still must be done on the rich pteridophyte flora; and the groups of lower cryptogams and fungi (except those of interest to agriculture and forestry) rarely if ever have had resident workers. Only in the 1970s and 1980s has more attention been paid to some of these groups, and major efforts made to produce modern catalogues: hepatics

(Grolle & Piippo 1984); lichens (Streimann 1986); and mosses (Koponen & Norris, in preparation). Shaw (1984) revised and expanded her compendium of pathogenic fungi and other microorganisms. The four expeditions (1964–1975) from the Tokyo National Science Museum have resulted in several papers covering most cryptogam groups. Marine algae have been studied in the vicinity of the King Leopold Research Station and elsewhere. But these are only a start.

An effective understanding of diversity, however, comes not merely from increasing collecting density or production of general floras or check-lists, however useful they may be. It comes from field study and recognition of meaningful biological entities, an area opened for New Guinea by Wim Vink's analysis of *Drimys* (Vink 1970). Stevens (1989, p. 126) has given other examples. To these I can add *Dracontomelum* (Anacardiaceae) where for Papuasia at least I believe the account in *Flora Malesiana* (Hou 1982) does not reflect the true situation. Similar comments may be made of *Allophylus* and *Pometia* in the Sapindaceae, *Terminalia* in the Combretaceae, and possibly *Intsia* in the Leguminosae. Such studies must pay close attention to local habitat, ecology and floristic differentiation (cf. Ashton 1988). Added to the evidence from primarily herbarium-based studies, they are potentially of real value to informed decisions about land stewardship.

III. Conclusion

I shall close by saying simply that our present state of botanical progress in Papuasia — and it is well advanced — has been, with some notable exceptions, rather more the work of individuals than as part of long-term collective goals. Botany — and, to a greater or lesser extent, other sciences — have had to develop in often limited and unstable political and administrative environments, with weak institutions, few if any policies, and often limited means and outlooks. The lands have moreover suffered the dislocations of administrative changes, war and rebel activities. In recent years priority has gone to problem-solving projects and related research, of which the control of the highly invasive water-fern *Salvinia molesta* in the 1980s provides a good example. But Papuasia is such that flexibility and patience will always be called for. Consolidation and advance of botanical knowledge in the long run remains as necessary and important as it was to Lam 55 years ago, and we must look at further ways to achieve it.

To this end the potential of information systems technology has scarcely begun to be tapped, in part because the effective spread of computers in New Guinea was late. Apart from primary documentation, including a geoecological database[2], its use would be valuable in research on medicinal plants — an area which with some exceptions has not received much attention in the region (Matainaho 1984), in ethnobotany generally (cf. Wasserman 1989), and in improving our understanding of Papuasian vegetation, including its description and classification (cf. Grubb & Stevens 1985; Smith 1987). The last-named is of particular concern: we still know relatively little of the lowland and upland forests to about 1,500 metres, including those where dipterocarps are significant — yet it is in these zones that extractive logging has been most active. Among the few major studies is one on the Gogol forests by Simon Saulei, now with the Forestry Research Institute in Lae.

In addition to vegetation studies, more attention should also be paid to exploration of unknown or poorly collected areas and the study of taxic differentiation and diversity. Stevens (1989, p. 127) has provided a map of 'well-collected' areas in Papuasia (exclusive of the Solomons) based on about 50 specimens/100 km^2. But even this density may not be high enough, as we move beyond basic inventory towards the challenges posed by the study of diversity, one of the finest of intellectual pursuits. Improved knowledge of the plants in the field is, moreover, a requisite to informed decisions about conservation, development, and land stewardship.

Ways should also be found to increase local appreciation (and political awareness) of botanical diversity. In basic taxonomy, much more can — and should — be done at the grass roots, providing 'stepping stones' rather than 'dream edifices' (Ng 1988). The students' manuals of Johns represent such stepping stones, as do present and future local floras and check-lists. There remains room, however, for responsible, long-term collaboration: the needs are, and likely will remain for some time, too much for the Papua New Guineans in the field to handle unaided. It will not be easy, for the body of interested and active persons is small, and has shrunk in the last decade or so. Papua New Guinea and its neighbours continue to develop, however, and there is always opportunity for more initiatives, especially with new or renewed institutions such as the Forest Research institute.

2 The Department of Agriculture and Livestock now has a Resource Information System (PNGRIS) Unit.

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Mary Strong Clemens: a botanical collector in New Guinea (1935–1941)

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An itinerary of Mary Strong Clemens's New Guinea field work is here provided in order to clarify some inconsistencies that appear on the herbarium labels. The reliability of the locality details given on some of the specimens collected from the higher altitudes is sometimes questionable. Clemens paid her native collectors, offering them more money if they collected from higher elevations (Croft pers. comm., May 1988). Therefore, they may have found the temptation to exaggerate the altitude of a collection difficult to resist! In fact van Royen (1980) has suggested that she probably never visited the summit of Mt Sarawaket, although field information on some of her collections suggest that she may have. Furthermore, the Reverend G. Bergmann (then Lutheran Missionary, Boana) (pers. comm., 19 February 1977) believed that she had visited the summit of Mt Sarawaket. Indeed, *he* may have taken her to the summit (see caption to Fig. 1). In a letter to Miss Carrie Harrison (Brookland, Washington D.C., U.S.A.) Mrs Clemens writes from 'Near Timberline Camp' [Mt Sarawaket], 'Just arrived from the most strenuous 9 days hike of my life'(see caption to Fig. 2). It seems reasonable to suggest that she may have visited the summit of Mt Sarawaket on this occasion. Both photographs appear to record the same event. However, without her notebooks, it is not possible to confirm either point of view.

Mary Knapp Strong was born in New York (U.S.A.) on 3 January 1873 (based on her diary entry, as cited in Carter 1982, p. 168). She died at Chermside (Australia) on 13 April 1962, aged 95 (Langdon 1981). In 1896 she married Joseph Clemens who was born in Cornwall (England) in 1862. He died at Wareo (Territory of New Guinea, now Papua New Guinea) on 21 January 1936. Further biographical details are provided by Langdon (1981). Carter (1982) provides an itinerary of Clemens's Queensland (Australia) field work that was undertaken after she left New Guinea.

Joseph and Mary Strong Clemens arrived at Salamaua, in the (then) Mandated Territory of New Guinea on 16 August 1935. Joseph died of food poisoning (van Steenis-Kruseman 1950) a few months after their arrival (21 January 1936). This occurred on the Wareo cart road (north of Sattelberg) as he was proceeding to a German Lutheran Mission conference in Finschhafen (Langdon 1981). Mary Clemens recorded the death of her husband on the label of Clemens 1668 (held at B), 'It was under this tree [*Myristica lancifolia* var. *clemensii*] that my soul companion for over 40 years of wedded life, bade me farewell for the higher life.' (Sinclair 1968, p. 465). She dauntlessly continued as a botanical collector until the Japanese military invasion of New Guinea made it necessary for her to be hurriedly evacuated to Australia on 26 December 1941.

Mary Clemens collected almost exclusively in the Morobe Province, and mostly on the Huon Peninsula where she made about 14,000 collections of plants. In September 1939 she made a brief visit to the Upper Ramu River area of the Madang Province. Her New Guinea collections were sent to Botanischer Garten und Botanisches Museum Berlin-Dahlem (B), Berlin, BRD (much of which was destroyed but duplicates have survived elsewhere) until 1939. Hiepko (1987) recorded that between 1935 and 1939, B received 8,772 numbers of M. S. Clemens's New Guinea collections (with duplicates), of which about 2,600 numbers (with duplicates) survived. From 1939 until 1941, she sent her specimens to the Herbarium of the University of Michigan (MICH), Ann Arbor, Michigan, U.S.A. (Frodin & Gressitt 1982). Her subsequent Australian collections (from 1943 through 1950) were also sent to MICH (Carter 1982). It is assumed that the notebooks which recorded her daily activities up to mid-1941, together with the plant collections that were to be despatched to MICH, remained in New Guinea when she was evacuated from Lae (26 December 1941). These collections were abandoned at Lae, and possibly at Boana or Finschhafen when transport was not available during the Second World War. Some of Clemens's New Guinea collections are held at the National Science Museum, Tokyo, Japan (TNS) and the Herbarium of the Kyoto University (KYO). It was assumed by van Royen (1980), and Frodin & Gressitt (1982) that these represented some of the abandoned collections that had been taken by the Japanese when they occupied Papua New Guinea. It is not known how or when Clemens's collections arrived in Japan, but some of the specimens that are now held by TNS may have been donated by the Herbarium of the Swedish Museum of Natural History, Stockholm, Sweden (S) because they have a Stockholm label on them (Inoue, pers. comm., 30 August 1988). Frodin & Gressitt (1982) reported that her collections have also been located at the Herbarium of the University of Tokyo (TI). However, Iwatsuki (pers. comm., 28 June 1988) states that 'we [TI] have no specimens collected by Mrs Clemens nor original materials [notebooks] of her.' TNS has 105 unnumbered specimens of bryophytes (Inoue pers. comm., 2 July 1988). Only a few of these collections have been critically studied (Noguchi 1953).

In 1983, a pre-war loan of 326 sheets of ferns were returned to B from BM. A list of these collections

Fig. 1. Mary Strong Clemens. The back of the photograph has written in Clemens's hand, '10–12 000 ft elevation Camp, Morobe Distr[ict], New Guinea. Taken by Rev. G. Bergmann Lutheran Missionary from Boana Sta[tion]. He was taking a party up Mt Sarawaket 13,500–14,000 ft. About yr. [year] 1939–1940. M.S. Clemens.' Photograph probably taken at or near the 'Timberline Camp', Mt Sarawaket, May-June 1939.

Fig. 2. Mary Strong Clemens and Alaseu, a field assistant. On the back of the photograph is the following typed letter from Clemens to a Miss Carrie Harrison of Brookland, Washington D.C., U.S.A. 'Near Timberline Camp, May-June, 1939. Note roof of tussock grass, and the wash-basin by Alaseu on the stump of tree fern. The mossy bush behind me has rusty *Rubus*, and rusty *Aspelnium* [*Asplenium*], the pond has rusty *Viola* where the wallaby (marsupials) play. Pittosporums almost touch one end of the hut. Here grows my n. sp. of *Veronica* [*V. platycarpa*] described by Dr Pennell. *Podocarpus* and other conifers with oodles of heaths and lichens filled our baskets here, but this ancient, borrowed, Boana machine [referring to herself] declines to think more. Mary Strong Clemens.' She then added, 'Plane is due, this is just to acknowledge your letter with the astonishing prices for grass as I have given about a ton of alpine ones for naught. Just arrived from the most strenuous 9 days hike of my life. M.S.C.'

(Anon. 1982) was distributed to several herbaria, including B, BM, BRI, CANB and NSW (Jermy pers. comm., 12 August 1988).

Mary Clemens numbered her New Guinea collections from 1 onwards. Her New Guinea phanerogam collections (held at B) begin with the number 3 (August 1935) and end with the number 10,105 (3 April 1939) (Hiepko pers. comm., 18 July 1988). However, the specimens were not numbered at the time of gathering. Hence, the numbering of her collections has created various problems. Some of the numbers are mixed collections and others are not in chronological order. Her fern collections, as listed in Anon. (1982) for the period of October 1935 until June 1938, appear to be more inconsistently numbered than her other collections. It appears that the fern collections from a particularly area (often gathered over several days) were frequently numbered as a group, distinct from the other collections. Native helpers often brought plant material back to her at a base camp where she numbered the specimens (van Royen 1980). Alaseu (see Fig. 2) was one New Guinean who assisted her on several occasions. He collected the ferns from Abe [exact locality not know, it is thought to be somewhere between Boana and Mt Sarawaket] in 1938 (Anon. 1938). Some collections were assigned numbers after they were despatched from New Guinea. Professor H. H. Bartlett (MICH) 'undertook the distribution and sale of duplicates in Mrs Clemens' behalf' (Carter 1982, p. 163). These collections are numbered from 40,598 to at least 41,963 (Anon. 1936–1941) and cover the years of 1939 to 1941.

The following itinerary is based on the collections held at the Queensland Herbarium (BRI), the University of Michigan (MICH) and information cited in selected publications that are listed in the references (below). The information provided in the itinerary include: dates (when known), collection localities, and Clemens's collection numbers (in square brackets). The collection numbers that are listed represent the known numbers. In most instances, they do not cover the full range of collections at any particular locality, for a certain date. The localities from which it is known that Clemens collected (i.e. collections seen or cited in publications) are marked by a solid triangle on the accompanying maps (Figs 3–7). Other localities are marked by a dot.The major areas of New Guinea that

were collected by Clemens (in alphabetical order) include: A-mieng, Boana, Finschhafen (north of present Finschhafen), Gaeng, Kaiapit, Kalasa, Kulungbufu, Lae, Malahang, Malolo, Matap, Mt Sarawaket, Musom, Ogeramnang, Quembung, Rawlinson Range, Salamaua, Samanzing, Sambangan, Sattelberg, Sugu, Tobou, Wantoat, Wareo, Wau, Yoangen and Yunzaing.

1935

AUGUST: 16 — Joseph and Mary Strong Clemens arrived at Salamaua, in the then Mandated Territory of New Guinea; **27** — collected at Malolo (also spelt Malalo) Mission (probably stayed there) and Salamaua [coll. 1–46]; **30** — Malahang [coll. 62 (Burret 1936)]; **31** — arrived Finschhafen (van Steenis-Kruseman 1950).
SEPTEMBER: no date — stayed at Heldsbach Plantation [coll. 103]; **20–30** — Sattelberg [coll. 173–204].
OCTOBER: 1–24 — Sattelberg [coll. ?169, 276–625].
NOVEMBER: 1–21 — Sattelberg [coll. 698–1015]; **26** -Sattelberg to Quembung [coll. 'suppl.', B (Danser 1938)].
DECEMBER: 1–3 — Sattelberg [coll. 1061–1098, 1221]; **6** — Sattelberg [coll. 1109 (Burret 1936)]; **11** — Quembung [coll. 1141–1275]; **13** — Quembung [coll. 1123, and possibly 1313–1494]; **19** — Sattelberg [coll. 1255]; **no date** — Sattelberg [coll. 1331]; **27–31** — Wareo [coll. 1356–1668].

1936

JANUARY: 1–17 — Wareo [coll. 1420–1717]; **29** — Sattelberg [coll. 1717–1742].
FEBRUARY: no date — Sattelberg [coll. 1760]; **4** — Wareo [coll. 1769–1838]; **7** — Wareo [coll. s.n., B (Danser 1938, p. 52)]; **15** — Sattelberg [coll. 1848–1859, 1891]; **no date** — Sattelberg, on trail to Wareo [coll. 1860].
MARCH: no date — Sattelberg [coll. 1927–1973]; **4–12** — Sattelberg [coll. 1950–2022]; **23-?** — Quembung Mission (sometimes spelt Fuembung) [coll. 2110–2168, 2183, 2200, 2238]; **no date** — Sattelberg [coll. 2173, 2186, 2225 (given as April), 2239].
APRIL: 7–9 — Sattelberg [coll. 2270–2281]; **18–25** — Yunzaing [coll. 2346–3004 (2379–2389 from Mt Aloki)]; **no date** — Sattelberg [coll. 3034–3078].
MAY: 12-? — Sattelberg [coll. 3080–3108].
JUNE: 2 — ?between Yunzaing and Yoangen [coll. 3189]; **8** — Yunzaing [coll. 3235]; **18** — between Yunzaing and Yoangen [coll. 3351–3381]; **22–23** — Yunzaing [coll. 3381A-3415]; **no date** — Yoangen [coll. 3426]; **25–26** — Yunzaing [coll. 3435–3460]; **no date** — Yunzaing [coll. 4193] (given as April); **27** — Yunzaing [coll. 4195B]; **29** — Sattelberg [coll. 3450], Yunzaing [coll. 3451–3523; date of coll. 3473 is cited as 18 June by Burret (1937)].
JULY: 1–31 — Yunzaing [coll. 3494–3749 (some numbers out of sequence)].
AUGUST: 1–6 — Yunzaing [coll. 3761–3810]; **11–25** — Yunzaing (sometimes spelt Junzaing) [coll. 3828–4074].
SEPTEMBER: 3-? — Yunzaing [coll. 4076–4148]; **no date** — Yunzaing [coll. 4183 & 4207]; **no date** — Finschhafen [coll. 4215].
OCTOBER: no known collections.
NOVEMBER: 16 — Yunzaing [coll. 4194]; **no date** — Malolo Mountains and Malolo Mission [coll. 4359–4412; 4372 is probably incorrectly dated the 12th (Burret 1943); 4404A incorrectly dated December; if the locality and date information is correct, Clemens must have visited Malolo before returning to Ogeramnang]; **no date** — Ogeramnang [coll. 4447 & 4463].
DECEMBER: 7–31 — Ogeramnang [coll. 4489–4803, 4809, ?4826-?4884, 5214; 4791 a mixed collection of *Myristica cucullata* from Ogeramnang (Sinclair 1968) and *Carpodetus major* from 'Kaile to Sarawaket' (Reeder 1946)]; **12–17** — between Ogeramnang and Malang [coll. 4635–4724]. Clemens collected in the Ogeramnang area throughout December and the numbering of these collections is not always chronological.

1937

JANUARY: 1–9 — Ogeramnang [coll. 4827–4902]; **no date** — 'above Kaile, enroute to [Mt] Sarawaket' [coll. 4910]; **11-** Ogeramnang [coll. 4996 (Danser 1938) is not in chronological sequence]; **12** — Ogeramnang [coll. 4934–4955]; **no date** — 'Bulung River and Kaile' [coll. 4964]; **?(at least 14)-28** — Ogeramnang [coll. 4972–5200; coll. 5156 from Yunzaing cited as collected on '27.i.1937' (Danser 1938)]; **no date** — 'Nomanenem Camp, Bulung River' [coll. 5206]; **30** — locality not known, probably between Ogeramnang and Goliteng Camp] [coll. 5218]; **no date** — Camp Kilanda, on trail to Mt Sarawaket [coll. 5236]; **30** — Camp Busu Tamunac, Sarawaket [coll. s.n., B, L (Danser 1938)].
FEBRUARY: no date — Goliteng camp, Belum (?Bulum River), on trail to Mt Sarawaket [coll. 5247–5307]; **1** — Camp Busu Tamunac, Sarawaket [coll. s.n., B, L (Danser 1938)]; **8** — Ogeramnang [coll. 5326, 5327A & 5539]; **9** — Bulung River (sometimes spelt Butung River), near Ogeramnang [coll. 5337–5358]; **?(at least 12)-27** — Ogeramnang [coll. 5368–5475, 5483 & 5484, 5498–5536; 5487a dated February from Sattelberg is either incorrect locality or incorrect date].
MARCH: no date — Mt Sarawaket [coll. 5556–5575; 5573 is incorrectly dated June — Clemens in Yunzaing then]; **no date** — Mt Sarawaket [coll. 5666a, 5673 & 6120]; **no date** — Ogeramnang [coll. 5921 & 6040]; **no date** — Kaile [coll. 6038]; **31** — 'Bog meadow camp, Mt Sarawaket' [coll. 6157].
APRIL: specimens from Mt Sarawaket are not numbered in chronological order. **6** — Mt Sarawaket [coll. 5863]; **7** — 'Terminal camp, Mt Sarawaket' [coll. 5740]; **8** — summit of Mt Sarawaket [coll. 5642]; **no date** — Mt Sarawaket [coll. 5672 & 5733]; **10** — [on route from] 'Terminal camp to Bog meadow, Mt Sarawaket' [coll. 5814], and 'Trail below Terminal camp' [coll. 6194].
MAY: coll. 6269, 6274, 6275 & 6325 have been cited as from Busu or the Busu River by Smith (1944), Merrill & Perry (1941), Smith (1944), and Merrill & Perry (1948) respectively. The locality or date of these

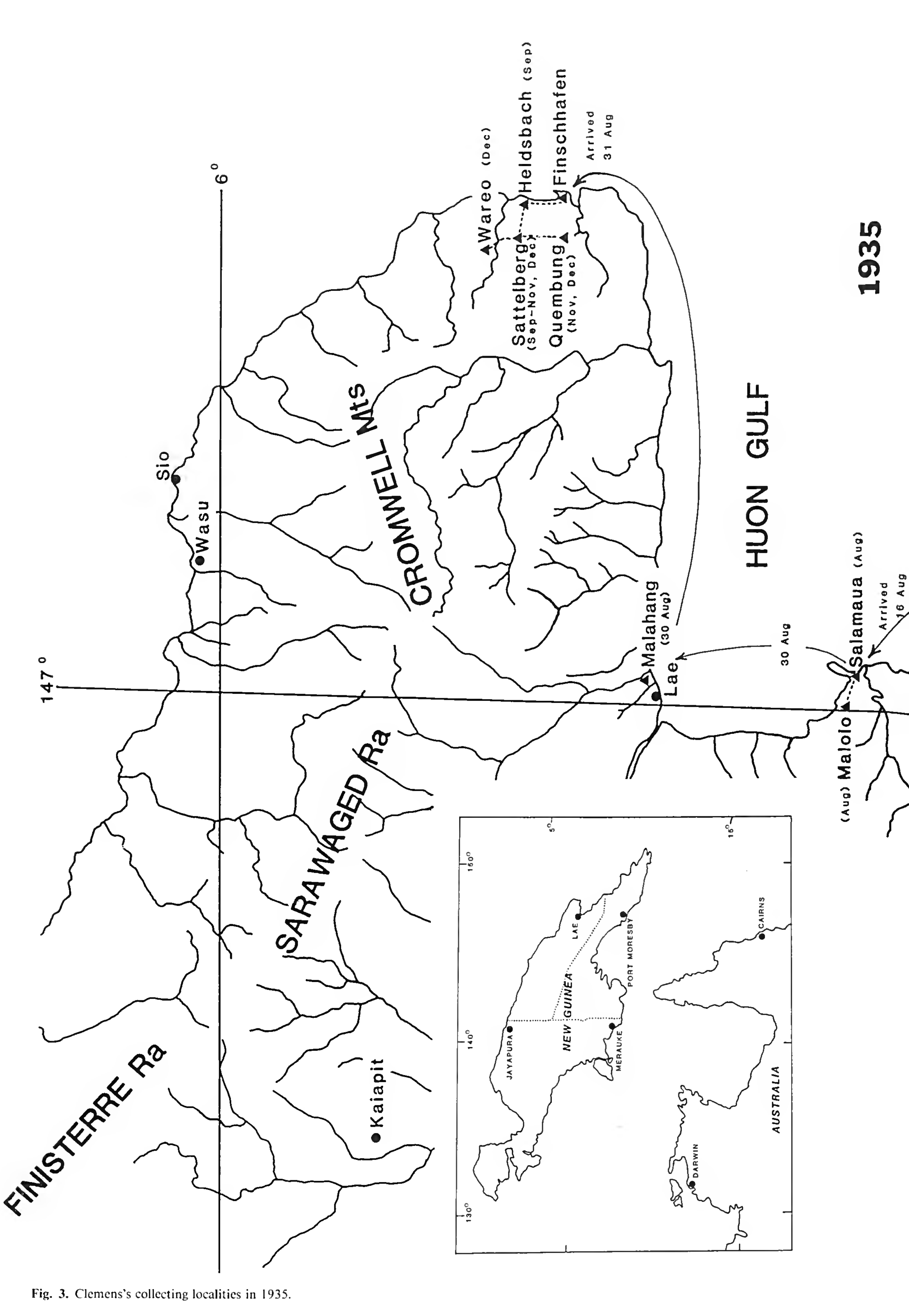

Fig. 3. Clemens's collecting localities in 1935.

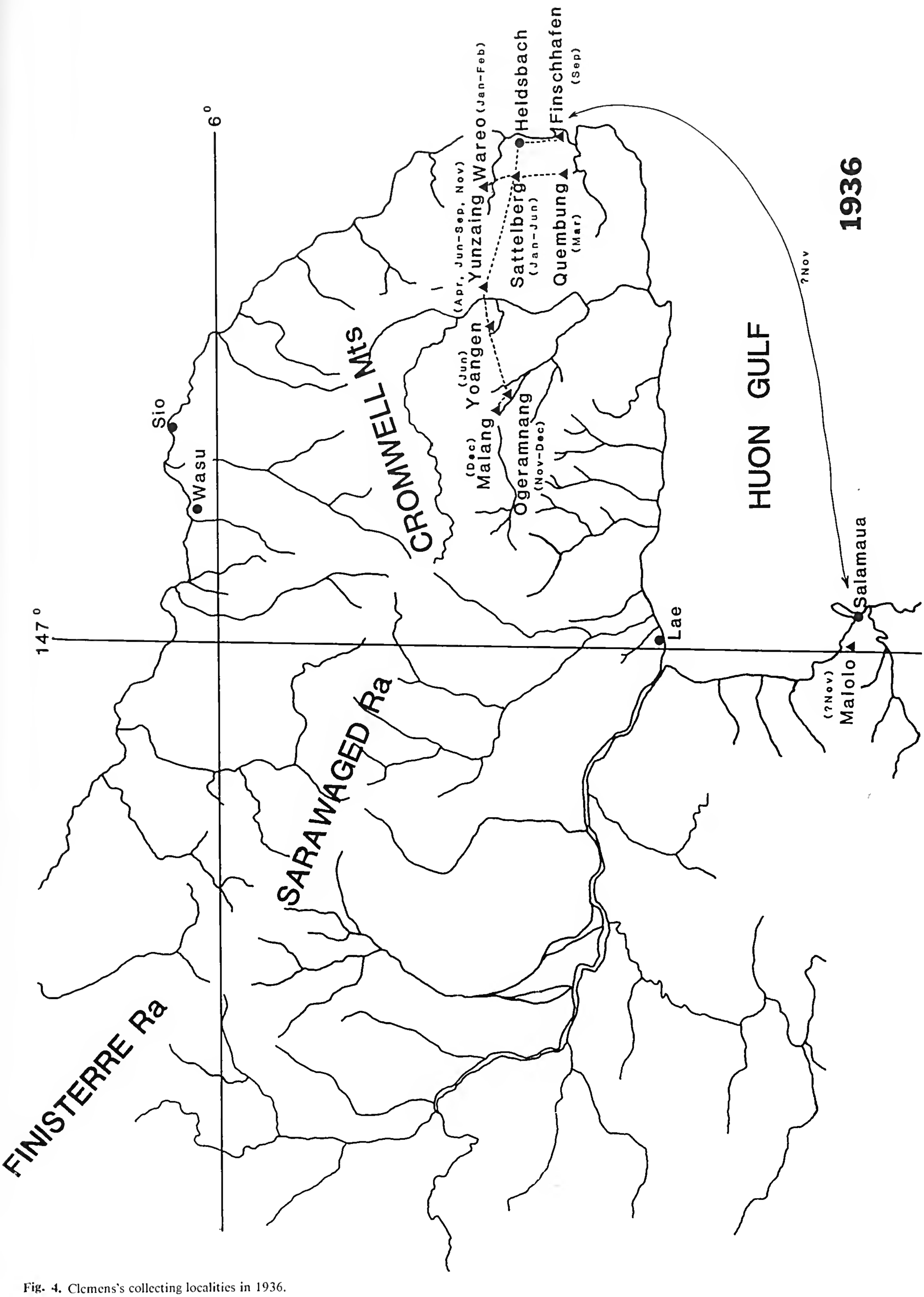

Fig. 4. Clemens's collecting localities in 1936.

collections appears to be incorrect. **12** — [coll. 6325]; **no date** — Ogeramnang [coll. 6357 & 6906].
JUNE: numbering, and/or dates and localities are very confused. Presumably, Clemens was returning from Ogeramnang to Sattelberg during June and July. She may have visited the villages of Kulungbufu, Tobou, Yoangen and Yunzaing several times. **?-21** — Yunzaing [coll. 6433–6471]; **no date** — Yoangen [coll. 6492]; **no date** — Tobou to Kulungbufu [coll. 6514]; **no date** — Kulungbufu (sometimes spelt Kulungtufu) [coll. 6520 & 6552]; **5** — Tobou [coll. 6543]; **no date** — Tobou [coll. 6557 & 6573]; **no date** Yoangen [coll. 6587–6606]; **no date** — Yoangen to Mongi [River] [coll. 6613]; **14** — Yoangen [coll. 6616].
JULY: no date — Kulungbufu [coll. 6617A-6650].
AUGUST: it is presumed that Clemens travelled by boat from Finschhafen to ?Wasu or Sio during July or August and then walked or was driven to Sambangan. Clemens acknowledges that many of the collections were made by New Guinea assistants. Several collections are not numbered in chronological order. **10** — 'Steep hills near village [?]' [coll. 6689]; **14** — Iloko (spelt as 'Iloco') [coll. 6714]; 17–31 — Sambangan [coll. 6735–6884].
SEPTEMBER: 1–18(-?) — Sambangan (these are frequently cited as 'Sambanga Mt, Sattelberg' or 'Sambanga, Sattelberg') [coll. 6897–7188]; **29** — Timbe River trail, Sambangan [coll. 7204 & 7205]; **30** — Sambangan [coll. 7231 & 7232].
OCTOBER: numbering and/or dates are very confused. **1** — Sambangan [coll. 7241–7244]; **5** — base of Mt Sarawaket [coll. 7345 & 7347]; **15** — 'Waterfalls by big lake [?Lake Gwam], Mt Sarawaket' [coll. 7346 & 7351]; **17** — 'Under tussock grass, ... near our rockwall tent, Mt Sarawaket' [coll. 7352 & ?7352A]; **19** — 'near rockwall' '& lake', Mt Sarawaket [coll. 7343 (possibly collected on the 18th), 7348 & 7355]; **20** — Mt Sarawaket [coll. 7430]; **22–23** — Timbe River trail, Sambangan [coll. 7256 & 7257, 7438–7440, 7453, 7462]; **no date** (probably 22th or 23rd) — Timbe River, Sambangan [coll. 7562A]; **25–30** — Sambangan [coll. 7259, 7417, 7440A, 7445, 7446, 7456a].
NOVEMBER: 1–5 — Sambangan [coll. 7473, 7475A (given as 29 October) & 7492A, & 7949 Suppl.]; **9** — 'River [Masak] margin below village', Sambangan [coll. 7520, 7521, 7528, 7532, 7542], [presumably the Masak River area, near Sambangan, at the base of] 'Mt Sarawaket' [coll. 7550], Masak River [coll. 7550B]; **16–30** — Sambangan, including Timbe River on the 25th and 30th [coll. 7608–7810b].

The numbering of the fern collections (Anon. 1982) is not in chronological order, and the range of numbers is as follows: **16** — [coll. 7657–7680]; **17** — [coll. 7616 & 7617]; **18** — [coll. 7642–7649a]; **23** — [coll. 7710–7718a]; **24** — [coll. 7721a, 7727 & 7864a Suppl.]; **25** — [coll. 7736–7743bis]; **26** — [coll. 7746–7776, & 7824 Suppl.]; **28** — [coll. 7781]; **30** — [coll. 7794–7809].
DECEMBER: 3 — Sambangan [coll. 7838 ?Suppl., 7849bis, 7949 Suppl.]; 6 — Koeg and Koek rivers, Sambangan [coll. 7857–7878bis Suppl., & 7900]; **9** — Masak River, Sambangan [coll. 7882A-7898A]; 20 — Sio [coll. 7988–8000]; **no date** — Clemens presumably travelled by boat to Sialum and then on foot to Kalasa.

1938

Clemens returned to Sattelberg (presumably by boat from Sialum to Finschhafen) between January and March 1938.
JANUARY: 1–10 — stayed at the Mission station in Kalasa and all known collections for January were from here. **no date** — [coll. 7902C]; **3** — [coll. 7956 & 7957]; **4** — [coll. 7987 (Burret 1940)] [number out of sequence); **6** — [coll. 7923 & 7980L].
FEBRUARY: no collections known.
MARCH: 15 — Warco [coll. 8052]; **?24–29** — Sattelberg [coll. 8062–8068].
APRIL: 12 — Quembung Trail [coll. 8104] possibly proceeding to Finschhafen. Mid April to May, Clemens travelled to Malahang or Lae, presumably by boat. She then proceeded to Boana, probably by vehicle via the Markham Valley Highway; **30** — Boana (coll. 8141 (Burret 1940)].
MAY: 4–6 — Bonzok River, to the west of Boana [coll. 8083, 8179–8186]; ?- **29** — Boana, including Mt Boana [coll. 8219–8296].
JUNE: 15–18 — 'Abe, Sarawaket' mostly collected by Alaseu. Clemens noted that Abe is 'the last "helper" station of this distr[ict]' (Anon. 1982), presumably between Boana and Mt Sarawaket [coll. 4349a, 8328a-8360a (a mixed collection) & 8360B]; **19** — Boana [coll. 8299a (number out of sequence)].
JULY: 1 — Boana Hills [coll. 8386]; **11–18** — locality unknown. These collections may have been from either the Boana area or between Boana and Lae, and/or Samanzing [coll. 8444–8494]; **26** — Boana [coll. 8542 (Burret 1940)].
AUGUST: no collections known.
SEPTEMBER: no collections known.
OCTOBER: 27 — Samanzing [coll. 9132 (Burret 1943)].
NOVEMBER: no date — Samanzing [coll. 9218–9913]; **no date** — Upper Camp, Mt Sarawaket [coll. 9919–10078c].
DECEMBER: 13 — vicinity of Samanzing.

1939

Clemens remained in the Mt Sarawaket area until early July (based on her collections as held by MICH and those cited by Noguchi 1953). It is presumed that she was in Lae during July and travelled to Kaiapit via the Markham Valley Highway.
JANUARY: no collections known.
FEBRUARY: 28 — Mt Sarawaket [coll. s.n., TNS]
MARCH: 22 — Mt Sarawaket [coll. s.n., TNS]; **27–29** — Upper Camp A, Mt Sarawaket [coll. 10083–10090].
APRIL: 4–27 — Mt Sarawaket [coll. s.n., TNS].
MAY: 3–6 — Mt Sarawaket [coll 10216–10238]; **12–30** — Mt Sarawaket [coll. s.n., TNS].
JUNE: 8–12 — Mt Sarawaket [coll. s.n., TNS]; **26** — Ogao [Mt Sarawaket] [coll. s.n., TNS].
JULY: 5 — Samanzing to Milulunga area [coll. 10433–10436, 40606–40614]; **7** — Musom (often spelt Mosum) [coll. 10436T-10438]; Musom to Lae [coll. 10439, 40617 & 40618]; Lae vicinity [coll. 10440]; **12** — Malahang [coll. 10441]; **13–17** — Lae [coll. 10443–10455, 40615 & 40616 (Busu River); coll.

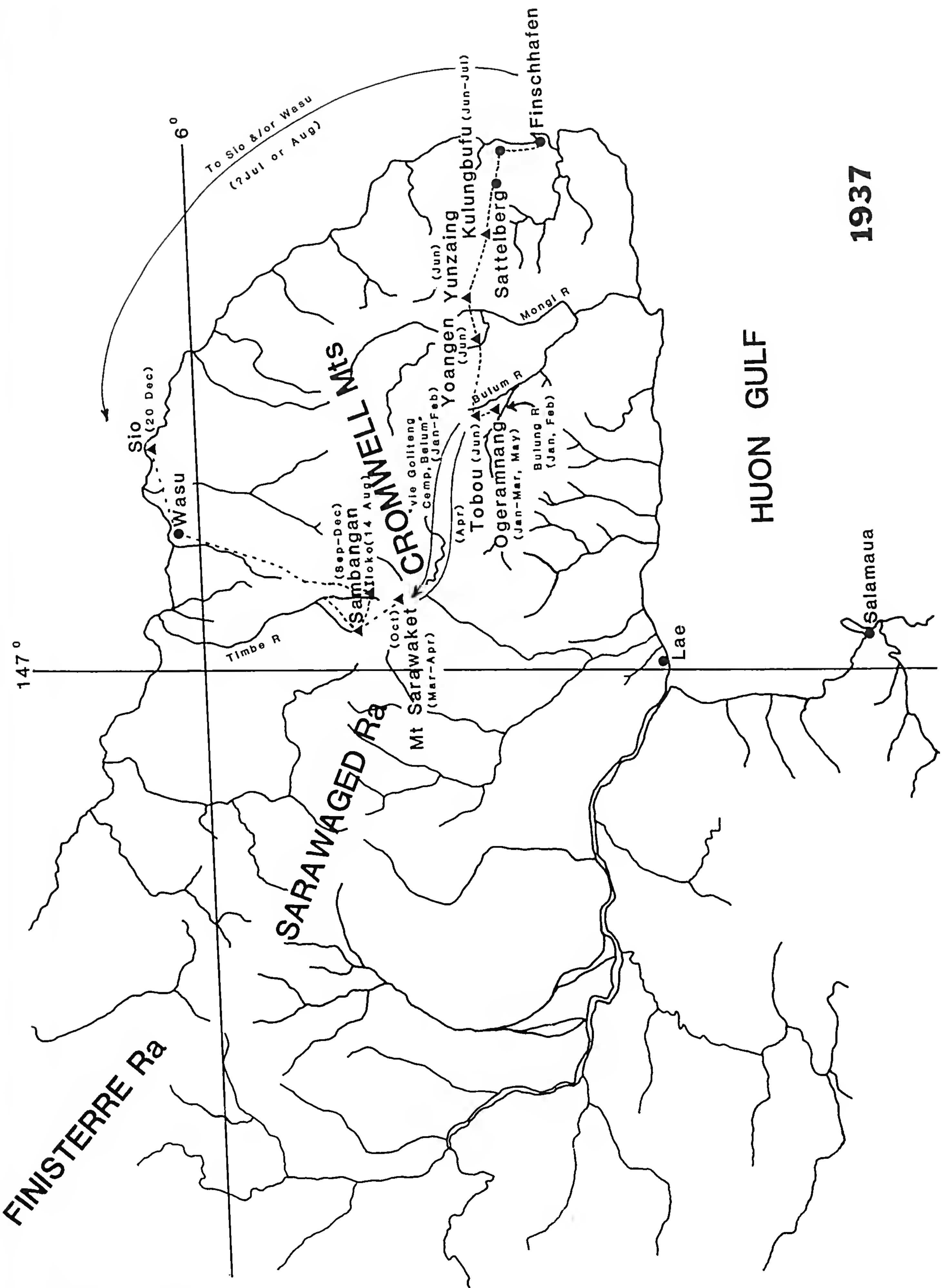

Fig. 5. Clemens's collecting localities in 1937.

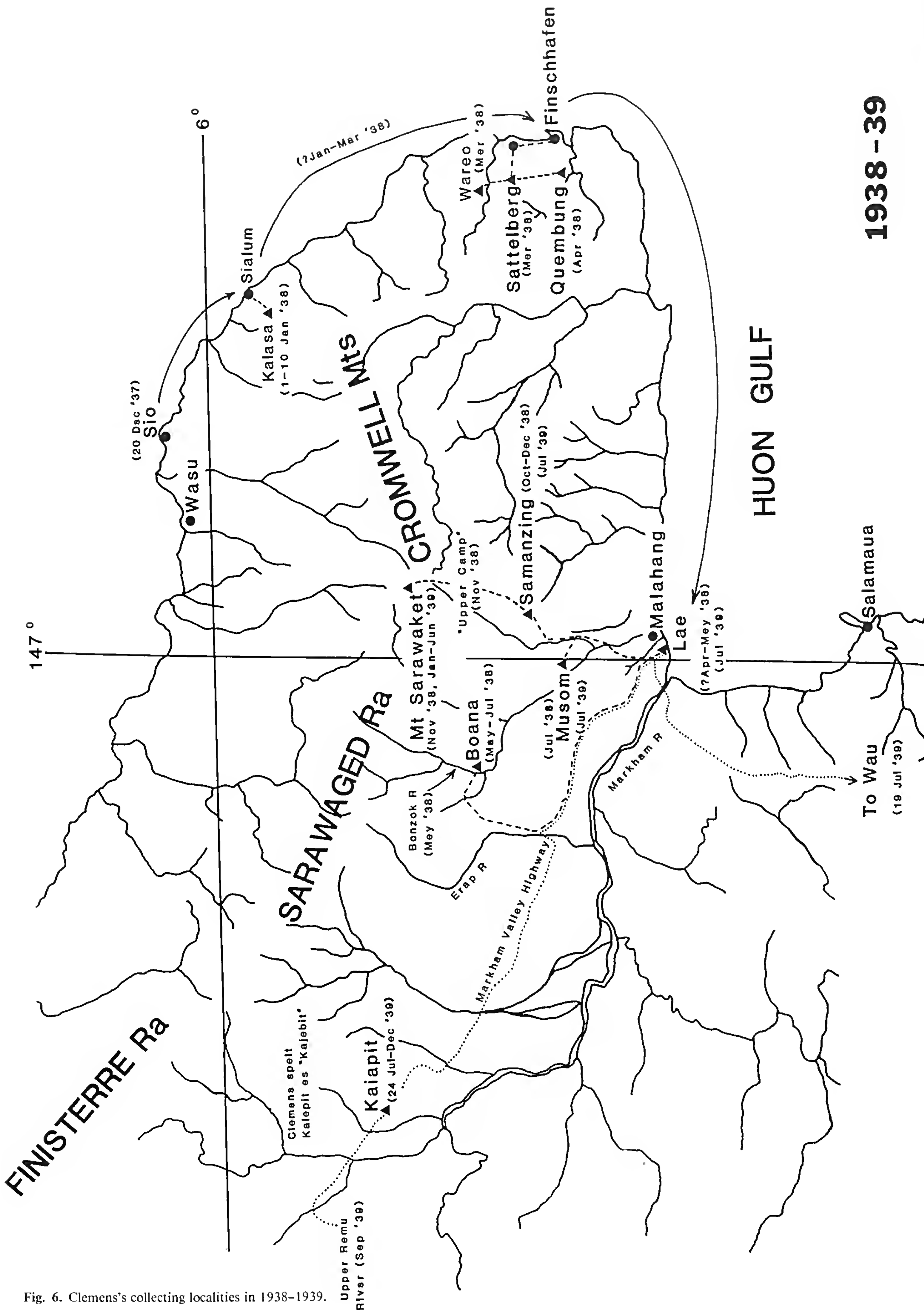

Fig. 6. Clemens's collecting localities in 1938–1939.

10455 (BRI) incorrectly cited as being collected during August, however, she was in Kaiapit then. The field note on coll. 10444R (MICH) states that it was collected on 15 September]; **19** — Wau [coll. 10456–10459bis, 40619–40622]; **20 & 21** — Lae [coll. 10460–10469bis, 40623 & 40623a]; **24–31** — Kaiapit (Clemens spelt it 'Kajabit') [coll. 10471–10523Z, 40624–40651].

AUGUST: 1–31 — Kaiapit[1] [coll. 10524–10634, coll. 10597 (MICH) collected 12 August)]; **1–9** — [coll. 40652–40682, 40726a-40729]; **9** — Markham Valley, near Kaiapit [coll. 40683–40685]; **10–17** — Kaiapit [coll. 40685–40702, 40730, 40845]; **22–26** — [coll. 40731–40739]; **30** — [coll. 40729a, 40740 & 40741]; **31** — [coll. 10635–10648, 40742–40744].

SEPTEMBER: 1–30 — [coll. 10649–10708M, 10723–10725, 10735–10737 (numbers out of sequence), 40658, 40745–40750, 40778–40785]; **6** — [coll. 40751–40754]; **11** — [coll. 40755]; **14** — [coll. 40756 & 40757]; **18** — [coll. 40757a-40762]; **20** — [coll. 40763–40768]; **21** — [coll. 40769]; **24** — [coll. 40771 & 40772]; **25** — [coll. 40773–40774]; **28** — [coll. 40775–40777]; **no date** — Kaiapit to Ramu [coll. 10726–10728, numbers out of sequence]; **no date** — Upper Ramu (River or Valley — actual locality not known) [coll. 10729 & 10730 (numbers out of sequence), 10738–10744bis (numbers out of sequence).

OCTOBER: 1–3 — [coll. 10709–10722]; **1** — [coll.40786 & 40787]; **3** — [coll. 10731–10734, 40788–40802]; **5–31** — [coll. 10745–10807]; **8** — [coll. 40803 & 40804]; **12** — [coll. 40805–40807]; **13** — [coll. 40808]; **16** — [coll. 40809–40812]; **18** — [coll. 40813 & 40814]; **19** — [coll. 40815 — 40817]; **20** — [coll. 40818–40821]; **23** — [coll. 40822]; **26** — [coll. 40823 & 40824]; **27** — [coll. 40825]; **31** — [coll. 40826].

NOVEMBER: 1–30 — [coll. 10808–10856]; **3** — [coll. 40827 & 40728]; **6** — [coll. 40829]; **12–14** — [coll. 40830 & 40831]; **17** — [coll. 40832]; **19** — [coll. 40833]; **20** — [coll. 40834]; **22** — [coll. 40835]; **23** — [coll. 40836–40837a]; **25** — [coll. 40838- 40838b]; **30** — [coll. 40839].

DECEMBER: 1–25 — [coll. 10857bis-10914, 40840 & 40841; coll. 10876 (BRI) incorrectly cited as collected in August]; **12** — [coll. 40842–40847; coll. 40844 (*Dioscorea esculenta*) distributed as 40843]; **15** — [coll. 40848 & 40849]; **18** — [coll. 40850 & 40851]; **20** — [coll. 40852 & 40853]; **21** — [coll. 40854–40855]; **25** — [coll. 40856]; **27** — [coll. 40857]; **29** — [coll. 40858].

1940

JANUARY: no date — Kaiapit to Dantap [coll. 10916]; **no date** — Dantap vicinity [coll. 10917]; **4** — above Dantap and Kaiapit [coll. 10918]; **no date** — Dantap to ?Yukmak [coll. 10919]; **no date** — above Dantap and Kaiapit [coll. 10922 & 10923bis]; **no date** — Wantoat[2] [coll. 10923, 40859–40861, 40865–40896]; **4** — [coll. 40862]; **8–31** — [coll. 10924–11065; coll. 10951 (A) cited as collected in 'January 1941' by Merrill & Perry (1948)]; **9** — [coll. 40862a-40864]; **10** — [coll. 40864a-40866]; **12** — [coll. 40867–40873]; **15** — [coll. 40874–40875]; **18** — [coll. 40876–40878]; **19** — [coll. 40879]; **20** — [coll. 40880–40883]; **22** — [coll. 40884]; **23** — [coll. 40885]; **24** — [coll. 40886–40893]; **25** — [coll. 40894–40896]; **26** — [coll. 40897]; **27** — [coll. 40898–40903]; **29** — [coll. 40904].

Clemens collected from Wantoat and Matap on several separate occasions, before visiting Boana.

FEBRUARY: 1–28 — [coll. 11066–11098a]; **no date** — Matap [position of Matap not known except that it is 'between Wantoat and the Range' (Frodin pers. comm., 1 July 1988)] [coll. 11099–11119A]; **no date** — Wantoat [coll. 11120]; **1** — [coll. 40905–40911a]; **2** — [coll. 40912 & 40912a]; **3** — [coll. 40913–40916]; **4** — [coll. 40917]; **5** — [coll. 40918–40926]; **6** — Matap [coll. 40927–40932]; **10** — Matap [coll. 11121]; **no date** — Wantoat [coll. 11122 & 11123]; **12** — Matap [coll. 11124 & 11124bis]; **12** — Wantoat [coll. 40933 & 40934]; **13** — Matap [coll. 11127]; **no date** — Wantoat [coll. 11127A]; **no date** — Matap [coll. 11127bis-11135a]; **no date** — Wantoat [coll. 11137–11147]; **no date** — Matap [coll. 11148]; **no date** — Wantoat [coll. 11149–11150]; **13** — Wantoat [coll. 40935]; **15** — [coll. 40937]; **19** — Matap [coll. 11151]; **19** — Wantoat [coll. 11151F]; **no date** — Matap [coll. 11152–11158e]; **21** — Wantoat [coll. 40938]; **22** — [coll. 40939]; **23** — [coll. 40940]; **24** — [coll. 40942 & 40943]; **27** — [coll. 40944–40946]; **no date** — [coll. 11124A-11126]; **no date** — [coll. 11159–11162]; **no date** — Matap [coll. 11163–11166]; **no date** — Wantoat [coll. 11167–11170]; **no date** — Matap [coll. 11171–11187]; **no date** — Wantoat [coll. 11188B-11200, 11220–11225A].

MARCH: no date — Matap [11200bis-11220; Reeder (1946) cited the locality of coll. 11211 (actually 11211bis) as Ogeramnang, but should be corrected to Matap]; **no date** — Wantoat [coll. 11221 & 11221bis]; **no date** — Matap [coll. 11221a, 40947–40951]; **no date** — Wantoat [coll. 11222, 11222A, 11223, 40952]; **no date** — Matap [coll. 11224–11257, 40953 & 40953a]; **no date** — Wantoat vicinity [coll. 40954 & 40955]; **no date** — Matap [coll. 40956–40967]; **1** — Matap [coll. 40968–40972, 40974–40976]; **1** — Wantoat [coll. 40973, 40977]; **2** — Matap [coll. 40978]; **2** — Wantoat [coll. 40979]; **3** — Matap [coll. 40980 & 40981]; **5** — Matap [coll. 40982 & 40983]; **6** — Matap [coll. 11258, 40984–40987]; **no date** — Matap [coll. 11260–11266]; **9** — Matap [coll. 11272]; **no date** — Matap [coll. 11275–11310A]; **no date** — Wantoat [coll. 11311]; **no date** — Matap [coll. 11311bis-11322H]; **no date** — Wantoat [coll. 11323]; **no date** — Matap [coll. 11323a-11324e]; **no date** — Wantoat [coll. 11325–11326B]; **no date** — Matap [coll. 11327 & 11327a]; **no date** — Wantoat [coll. 11328–11331]; **no date** — Wantoat [coll. 11333Z, number out of sequence]; **no date** — Matap [coll. 11334, number out of sequence]; **no date** — Wantoat [coll 11334D, 11336, 11336B, numbers out of sequence]; **no date** — Matap [coll. 11337, number out of sequence]; **no date** — Wantoat [coll. 11338, number out of sequence]; **12–15** — Matap [coll. 40988–41056]; **21** — Matap [coll. 41057–41059]; **22** — Matap [coll. 41060–41062]; **23** — Matap [coll. 41063 & 41064]; **25** — Matap [coll. 41065]; **26** — Matap [coll. 41066–41068]; **27** — Wantoat [coll. 41069 & 41070]; **27** — Matap [coll. 41071–41078]; **29**

1 All the following collections are from Kaiapit, unless otherwise stated.

2 All the following collections are from Wantoat, unless otherwise stated.

— Wantoat [coll. 41079–41090]; **30** — Matap [coll. 41091 & 41102]; **30–31** — Wantoat [coll. 41092–41101].

APRIL: **no date** — Wantoat [coll. 41103 & 41104, 41107–41109]; **no date** — Matap [coll. 11332–11333d, 11335–11335h (incorrectly labelled 11135 at MICH), 11338bis-11341bis]; **no date** — Ulap Trail, Matap vicinity [coll. 11342–11345, 41105]. The Ulap Trail appears to be a walking track across the Saraweged Range, presumably linking Matap, Boana, Sambangan with Ulap; **2** — Matap [coll. 41112 & 41113]; **3** — Wantoat [coll. 41114a & 41114b]; **4** — Matap [coll. 41118–41119a]; **5** — Matap [coll. 41120 & 41120a]; 6 — Matap [coll. 41115–41116a]; **6–7** — Ulap Trail, Matap vicinity [coll. 11346 & 11346A, 41121–41169]; ?6 — Ulap Trail [coll. 11347-11349]; 6 — Wantoat [coll. 41170]; **8** — Matap [coll. 11352, number out of sequence]; **11** — Wantoat [coll. 11350 & 11351, 41170–41175]; **?11** — Wantoat [coll. 11353 & 11354]; **no date** — Matap [coll. 11355A]; **no date** — Wantoat [coll. 11356–11358]; **12–16** — Wantoat [coll. 41176–41192, 41194, 41205]; **16** — Matap [coll. 41193, 41196–41204, 41206]; **16** — Ulap Trail [coll. 41195]; **17** — Wantoat [coll. 41207–41209; 41216 & 41217]; **17** — Matap vicinity [coll. 41210–41215c]; **19** — Matap [coll. 41218–41228, Merrill & Perry (1948) cited the locality of coll. 41125 as the Ulap Trail]; **no date** — Ewot (= ?Ewok) to Wanimbun [coll. 11360]; **22** — Ewot (= ?Ewok) [coll. 41232–41237]; **23** — Ewot (= ?Ewok) [coll. 41238]; **23** — Ewot (= ?Ewok) to Wanimbun [coll. 40703–40705, 41246, 41248]; **23** — Wanimbun [coll. 41239–41243]; **23** — Galumbu (= ?Gumi-Garambin) [coll. 41244]; **23** — Ewot (= ?Ewok) to Rumu River (the Rumu River flows between Wanimbun and Gumi-Garambin) [coll. 41245]; **23** — Wanimbun to Galumbu [= ?Gumi-Garambin] [coll. 41247]; **23** — Wanimbun (Rumu River) [coll. 41249 & 41250]; **24** — Galumbu (Rumu River) (= ?Gumi-Garambin) [coll. 41253]; **24** — Wanimbun to Galumbu (= ?Gumi-Garambin) [coll. 41254–41254d, 41256]; **24** — Galumbi (= ?Gumi-Garambin) [coll. 41255]; **25** — Finungwa (cited as Finangan by Clemens) [coll. 40706]; **25** — Galumbu (= ?Gumi-Garambin) [coll. 41257–41258]; **25** — Galumbu (= ?Gumi-Garambin) to Finungwa [coll. 41259 & 41260]; **no date** (?26) — Labisap (cited as Lapisap by Clemens) [coll. 11365, number out of sequence]; **26** — Labisap [coll. 41262, 41264, 41266 & 41273]; **26** — Finungwa to Labisap [coll. 41265 & 41267]; **27** — Labisap to Kisengam (cited as Kesengen by Clemens) [coll. 41268 & 41270]; **27** — Kisengam to Sugu [coll. 41271 & 41277]; **27** — Kisengam [coll. 41272]; **28** — Finungwa [coll. 40710]; **25–28** — Sugu vicinity [coll. 41274]; **25–27** — Labisap vicinity [coll. 41298]; **26–27** — Labisap to Sugu [coll. 41276]; **28** — Kisengam [coll. 41278]; **28** — Sugu [coll. 41280 & 41281]; **28** — Sugu to Gaeng (Patrol Post) [coll. 41282]; **29** — Kisengam to Sugu [coll. 40713]; **29** — Sugu to Gaeng [coll. 41287, 41284–41291]; **no date** (= ?29) — Gaeng (also spelt Gain) [coll. 40714, 40715, 41295]; **29** — Gaeng [coll. 41283, 41292]; **no date** (= ?29) — Gaeng [Patrol] Station (also spelt Gain) [coll. 40714, 40715, **30** — Gaeng [coll. 41295 & 41296]; **30** — Gaeng to Boana [coll. 11359 (number out of sequence), 40716, 41293, 41294 & 41300]; **30** — Boana [coll. 41297, 41299 & 41299a].

MAY: **no date [2–31]** — Boana[3] [coll. 11361–11364, 11366–11369; Merrill & Perry (1948) cite coll. 11366 (A) as being collected from Ewat (= ?Ewok) in April; 41304–41310; (the locality of coll. 41311 & 41311a, given as Rawlinson Range)]; **2** — [coll. 41312–41314]; **3** — [coll. 40717, 41117, 41315–41322]; **4** — [coll. 41323]; 6 — [coll. 40718, 41324–41331] 7 — [coll. 41332]; **8** — [coll. 41333 & 41334]; **9** — [coll. 40719–40722a, 41335–41344]; **10** — [coll. 41337 & 41348]; **15** — [coll. 40723, 40724, 41349–41371]; **18** — [coll. 40725, 40726, 41372 & 41373]; **21** — [coll. 41415 & 41416]; **23** — [coll. 41417–41421]; **26–27** — [coll. 41422]; **no date [?29]** — Malahang [coll. 41423 & 41424].

JUNE: **no date** — Boana[3] [coll. 11370, 41425–41428]; **2** — [coll. 41429 & 41430]; **4** — [coll. 41431]; **5** — [coll. 41432–41434]; 6 — [coll. 41435]; 7 — [coll. 41436–41439]; **8** — [coll. 41440 & 41441]; **11** — [coll. 41442–41445]; **12** — [coll. 41446–41450; **13** — [coll. 41451]; **14** — [coll. 41452–41457]; **16** — [coll. 41458 & 41450a]; **18** — [coll. 41459–41464a]; **19** — [coll. 41465]; **20** — [coll. 41465a-41467]; **21** — [coll. 41468 & 41468a]; **25** — [coll. 41469–41478]; 26 — [coll. 41479]; **27** — [coll. 41480–41489a]; **29** — [coll. 41490–41494].

JULY: **1** — [coll. 41496–41506]; 2 — [coll. 41507–41511]; 3 — [coll. 41512–41515]; **4** — [coll. 41516–41551A]; 6 — [coll. 41552]; **8** — [coll. 41553–41579]; **12** — [coll. 41580–41594]; **15** — [coll. 41595 & 41596]; 16 — [coll. 41597–41601]; **18** — [coll. 41602–41609]; **20** — [coll. 41610–41614]; **23** — [coll. 41615]; **25** — [coll. 41616–41621]; **26** — [coll. 41622–41626]; **27** — [coll. 41627 & 41628]; **29** — [coll. 41629–41632]; **30** — [coll. 41633–41646]; **no date** — [coll. 41647–41652].

AUGUST: **no date** — [coll. 11371]; **2** — [coll. 41653–41660]; 3 — [coll. 41661–41670a]; 6 — [coll. 41671–41673]; **8** — [coll. 41674–41680]; **9** — [coll. 41681–41686a]; **10** — [coll. 41687]; **12** — [coll. 41688]; **13** — [coll. 41689–41712]; **14** — [coll. 41713 & 41714]; **16** — [coll. 41715]; **17–19** — [coll. 41716 & 41717]; **19** — [coll. 41718–41724]; **20** — [coll. 41725]; **22** — [coll. 41726–41735]; **24** — [coll. 41736–41741]; **25** — [coll. 41742–41742c]; **26** — [coll. 41743–41751]; **26–28** — [coll. 41751a]; **27** — [coll. 41752 & 41753]; **28** — [coll. 41755–41759]; **29** — [coll. 41760–41765]; **30** — [coll. 41766 & 41767]; **31** — [coll. 41768–41774].

SEPTEMBER: **no date** — [coll. 11372, 11373, 41775–41779]; **2** — [coll. 41780 & 41781]; **3** — [coll. 41782–41788]; **5** — [coll. 41789–41795]; **6** — [coll. 41796]; **6–7** — [coll. 41797]; **7** — [coll. 41798–41811]; **10** — [coll. 41812–41815]; **12** — [coll. 41816–41824]; **16** — [coll. 41825–41827]; **17** — [coll. 41828–41835a]; **19** — [coll. 41836]; **20** — [coll. 41837–41841]; **21** — [coll. 41842]; **22** — [coll. 41843]; **23** — [coll. 41844]; **24** — [coll. 41845–41853]; **25** — [coll. 41854]; 26 — [coll. 41855 & 41856]; **27** — [coll. 41857]; **28** — [coll. 41858–41861].

OCTOBER: **1** — [coll. 41862 & 41863]; **2** — [coll. 41864–41869]; **8** — [coll. 41870–41880]; **10** — [coll. 41881–41883]; **12** — [coll. 41884]; **15** — [coll. 41885 & 41885a]; **16** — [coll. 41886]; **21** — [coll. 41887]; **23** — [coll. 41888]; **24** — [coll. 41889–41891]; **30** — [coll. 41892–41901].

3 All the following collections are from Boana, unless otherwise stated.

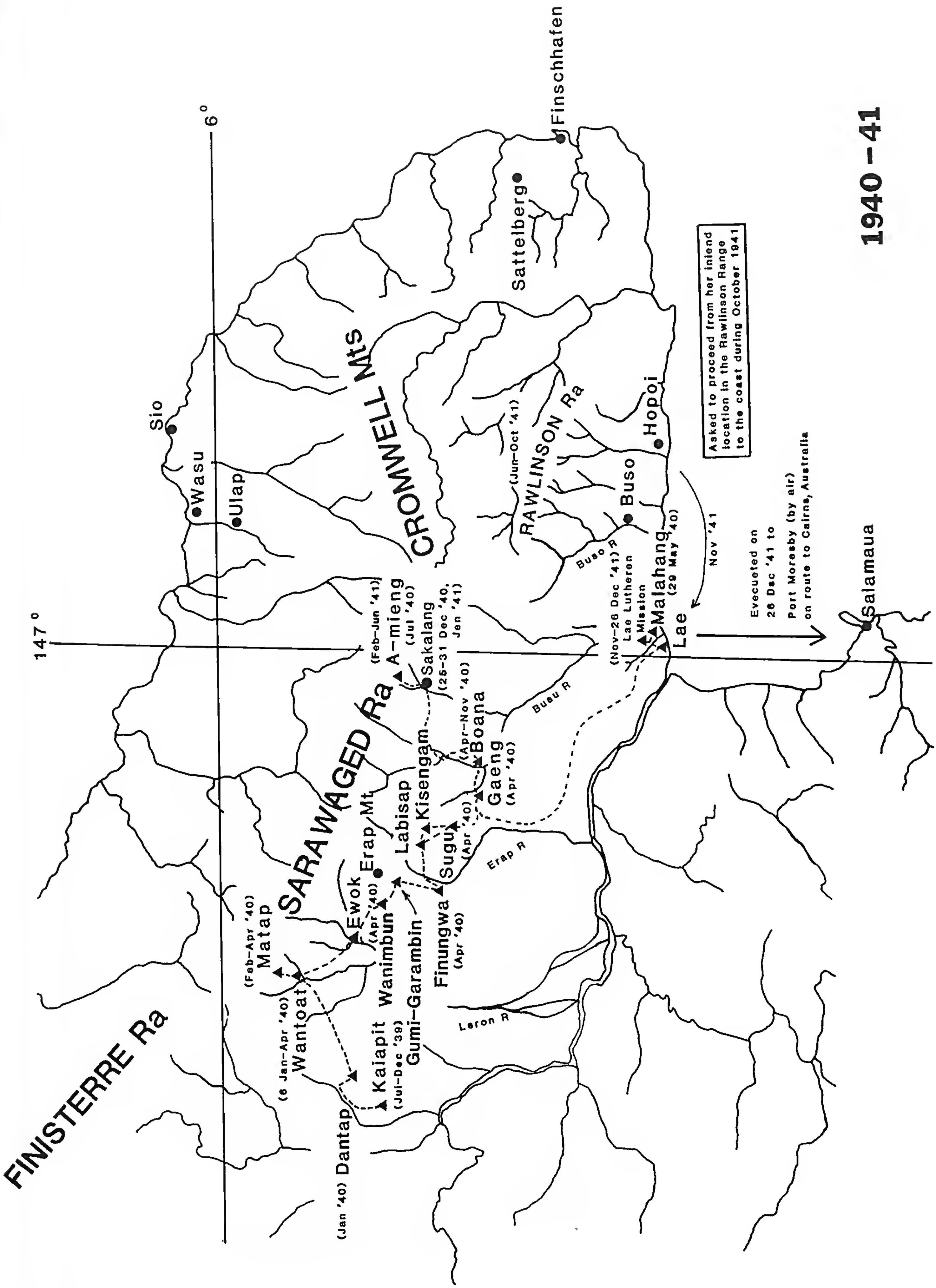

Fig. 7. Clemens's collecting localities in 1940–1941.

NOVEMBER: no date — [coll. 11379–11437]; **13** — [coll. 41902]; **14** — [coll. 41903–41911].
DECEMBER: no collections known; **25–31** — Sakalang Teacher Station (Clemens corresp., 31 Dec. 1940).

1941

Clemens was at the Sakalang Teacher Station at least from 25 December 1940. She wrote, 'We (the teachers and the surrounding countryside) celebrated Christmas . . .' (Clemens corresp., 31 Dec. 1940). She stayed there at least until 4 January 1941. She wrote from A-mieng that she had stayed in Sakalang so that her tropical ulcers could heal (Clemens corresp., 2 Feb. 1941). She regarded both A-mieng and Sakalang as being in the Rawlinson Range. However, both localities are on the Sarawaged Range. Therefore, it is possible that she never visited the Rawlinson Range or if she did, then it must have been late June or during July 1941 (see itinerary for 1941). Additional information is required for the period of June/July until October 1941.
JANUARY: no collections known. **4** — Sakalang Teacher Station (Clemens corresp., 4 Jan. 1940 [1941]).
FEBRUARY: no collections known. **2–4** — A-mieng (Clemens corresp., 2 Feb. 1941).
MARCH: Clemens collected exclusively from A-mieng during March until, at least, early July. The numbering of these collections is very confused. **2** — 'a days march from Sakalang' (Clemens corresp., 2 Feb. 1941); **no date** — A-mieng[4] [coll. 11805]; **no date** — Rawlinson Range [= ?A-mieng] [coll. 11975]; **no date [?13]** — [coll 12008]; **13** — [coll. 12008a-12017, 12011a & 12011b incorrectly dated 13 May]; **14** — [coll. 12018, 41912 & 41913]; **17** — [coll. 12032]; **21** — [coll. 12039, 12041]; **25** — [coll. 12056A-12056C]; **26** — [coll. 12089bis & 12089b, numbers out of sequence]; **27** — [coll. 12080, number out of sequence]; **28** — [coll. 12087B, number out of sequence].
APRIL: many numbers not in chronological order. **3** — [coll. 12073, 12093, 12095, 12095A]; **4** — [coll. 12094, 12109–12110B]; **9** — [coll. 12119–12120]; **12** — [coll. 12042–12054, 12110C-12110F]; **14** — [coll. 12038–12038A, 12039bis & 12039a]; **16** — [coll. 12055bis-12056, 12057–12066; 12057 & 12061 (MICH) are presumably incorrectly dated 16 August]; **24** — [coll. 12090, 12090A, 12097bis & 12098]; **26** — [coll. 12098A-12107A, 12143–12143b, 12222bis & 12222a]; **28** — [coll. 12138]; **29** — [coll. 12108]; **no date** — [coll. 41914]; **no date** — Rawlinson Range (= A-mieng)[coll. s.n., BRI 63881].
MAY: many numbers not in chronological order. **8** — [coll. 12177]; **12** — [coll. 12166 & 12166a]; **no date** — [coll. 41915–41921]; **14** — [coll. 41922 & 41923]; **18–20** — Rawlinson Range (= ?A-mieng area) [coll. 41374–41405, presumably incorrectly dated May 1940]; **20** — Rawlinson Range (= ?A-mieng) [coll. 41406–41412]; **20** — [coll. 12200bis-12200b, 12201a, 12202, 12213A & 12214]; **21** — [coll. 12201bis, 12203bis & 12203A]; **21** — [coll. 41924]; **22** — [coll. 12206–12213bis, 12215, 12216B & 12222, 41925–41927a]; **24** — [coll. 12217bis, 12219, 12223B, 12223C, 41928–41930]; **26** — [coll. 12221]; **27** — [coll. 12224–12234, 12236, 41931–41934]; **30** — [coll. 12235 & 12238]; **31** — [coll. 12239 & 12240].
JUNE: 3 — [coll. 12242–12248C]; **no date** — [coll. 41935]; **6** — [coll. 12269A-12290, 41936]; **10** — [coll. 41937]; **15** — Rawlinson Range (= A-mieng) [coll. 12311bis]; **18** — [coll. 41938]; **19** — [coll. 12295–12309, 12321–12319b, 12320–12322, 12328–12330, 41939–41942, some collections incorrectly refer to the Rawlinson Range or do not cite a collecting locality]; **27** — [coll. 12323–12327, 12332–12352, 12370–12370a, 41943–41958, some collections incorrectly refer to the Rawlinson Range]; **no date** — Rawlinson Range [coll. 41943]; **27** — s. loc. (Rawlinson Range) [coll. 4195B].
JULY: many numbers not in chronological order. **no date** — Rawlinson Range[5] [coll. 41959 & 41960]; **2** — [coll. 12355–12357a]; **4** — [coll. 12359bis-12368, 41961]; **7** — [coll. 41963]; **8** — [coll. 12441 & 12444c]; **9 & 10** — [coll. 12374–12379]; **11** — [coll. 12383bis-12384]; **12** — [coll. 12372–12373a, 12402–12404a]; **13 & 14** — [coll. 12379a-12381]; **15** — [coll. 12446–12448]; **17** — [coll. 12401 & 12401a]; **22** — [coll. 12333d-12445F]; **25** — [coll. 12405–12407a, 12443 & 12448bis]; **28** — [coll. 12467, 12417–12431]; **29** — 12435 & 12435a]; **30** — 12433 & 12444; **no date** — [coll. s.n., BRI 86266; coll. s.n., PH (Pennell 1943, p. 270).
AUGUST: 6 — [coll. 12448a-12448f]; **7** — [coll. 12472–12475, numbers not in sequence]; **8**- [coll. 12449–12470, 12478 & 12479]; **14–16** — [coll. 12485–12493]; **18** — [coll. 12496–12503e]; **22 & 23** — [coll. 12504–12507a].
SEPTEMBER: no collections known — possibly in Rawlinson Ranges.
OCTOBER: no collections known — possibly in Rawlinson Ranges. 'Late in October of 1941 . . . asked to proceed from her inland location to the coast' (Langdon 1981, p. 377). Unfortunately, the only extant notebook that covers this period has been misplaced at BRI (Johnson pers. comm., 21 June 1988). Two possible coastal (or near-coastal) destinations would be Hopoi Mission and Buso, or if she was collecting in the vicinity of Sakalang, then Lae would have been the most likely coastal destination.
NOVEMBER: 'Early in November . . . [she went to] the Lae Lutheran Mission' (Langdon 1981, p. 377), presumably by boat to Malahang or Lae (if based at Hopoi or some other coastal locality), or by foot and vehicle (if based at Buso or Sakalang). Apparently visited Boana. **3** — Boana [coll. 12788].
DECEMBER: no collections known. Langdon (1981, p. 377) notes that 'She went on collecting, drying specimens and packaging plants for transport by sea to the United States'; **17** — She noted the possibility of being evacuated to Australia; **20** — She received her evacuation orders, 'but the work of collecting and pressing specimens still went on' (Langdon 1981, p. 378); **26** -evacuated by aircraft from Lae to Port Moresby, then to Cairns (Australia).

Acknowledgements
I thank Dr R. W. Johnson (BRI) for generously allowing me access to the computer listing of Clemens's collections held at the Queensland

4 All the following collections are from A-mieng, unless otherwise stated.

5 The field notes of all the following collections cite the collection locality as the Rawlinson Range, unless otherwise stated.

Herbarium (BRI). I sincerely thank Drs P. Hiepko (B), H. Inoue (TNS), K. Iwatsuki (TI) and S. Kawano (KYO) for information concerning Clemens material held under their care. Dr C. Jermy (BM) supplied a list of New Guinea ferns collected by Clemens. Dr D. Frodin (PH) provided information on some New Guinea localities that I was unable to find. Dr A. A. Reznicek (MICH) kindly provided copies of Clemens's correspondence for the period of January until March 1941. Miss A. Carter (UC) located the photographs in this paper that are published with the kind permission of Dr B. Ertter (UC). Prof. R. J. Johns (Univ. of Tech., Papua New Guinea) provided information on Clemens's palm collections.

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The botanical collections of John Buchanan F.L.S.

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Abstract

John Buchanan, artist and botanist, 1819–1898, arrived in Dunedin, New Zealand from Scotland in 1852. Between 1852 and 1862 he was a small farmer, gold prospector as well as a part-time member of the Reconnaissance and Triangulation Surveys of the Province of Otago. In September 1862 he was employed by Dr James Hector as a botanical collector and later as botanist and draughtsman on the Otago Provincial Geological Survey and the Colonial Geological Survey and Museum in Wellington. He retired in 1885 from government service and returned to Dunedin. The plant collections he made over a period of forty years suffered from neglect, resulting in the loss of localized and dated specimens. Buchanan's botanical activities have, therefore, been traced from field notes, letters, ledgers and from his many plant and landscape drawings because some of the published statements concerning his collections have been incorrect or misleading.

John Buchanan, artist and botanist, was born on 13 October 1819, near Dumbarton, Scotland, on the estate of Levenside where his father was apparently a tenant of the Campbells of Stonefield. His childhood was therefore rural and, after attending the parish school, he was apprenticed as a pattern designer in the calico trade at one of the printworks in the Vale of Leven. He later lived in the village of Busby and was employed in the drawing shop of Henry Monteith & Co. where some of Scotland's famous, floral textiles were produced. This was the same firm that trained Walter Fitch, Kew's long serving botanical artist (King 1984). Buchanan's preparation of floral designs led to his desire to study botany. Little is known of Buchanan's botanical activities in Scotland except that he enjoyed the countryside and that he counted as his friends, Roger Hennedy, author of *The Clydesdale Flora*, and John Ross, the Busby doctor who had an interest in ferns and bryophytes.

Buchanan, like many other craftsman and artisans, chose to emigrate when a flood of mass produced textiles caused widespread unemployment in the Glasgow region. He left Scotland in 1851 and arrived in the Scottish Free Church settlement of Dunedin in February 1852 where, on the outskirts of the four year old township, he obtained a ten acre, hillside property in North East Valley.[1] It was in the damp, sunless bush of North East Valley that he began collecting the rich variety of ferns and mosses that grew in profusion on the trees and forest floor.

He made a short and unsuccessful visit to the goldfields of Victoria, and soon returned to clear and farm his property. In the following years he was employed on the Provincial Reconnaissance Surveys, the Geological Survey of Otago, and from 1865, served the Colonial Museum and Geological Survey for twenty years. He returned to his North East Valley cottage in 1885 where he died on 18 October 1898.[2] Buchanan was unmarried and his property was left to his brother, Peter, Assistant Government Printer of Sydney, whose eight children have continued the Buchanan line in Australia (the late David Saunders, pers. comm.).

The purpose of this paper is to examine some of the published statements made by Buchanan himself and those of Sir James Hector, Director of the Colonial Museum and Geological Survey, concerning the botanical collections that Buchanan made during his forty six years' residence in New Zealand. Most of these statements were made long after the events took place, creating a botanical myth. The most important components of the myth are that Buchanan, from the time of his arrival in New Zealand (purportedly in 1849), began sending consignments of specimens to the Royal Botanic Gardens, Kew (K); that these donations led to J. D. Hooker in 1861, recommending Buchanan to Hector as a skilled, local collector suitable for employment on the forthcoming Geological Survey of Otago; that Buchanan had a considerable private herbarium that was deposited in the Otago Museum at the time of his death.

The first of these statements requiring examination is the interview that Buchanan gave to a Dunedin newspaper in 1895.[3] He was reported to have arrived in Dunedin on the *Columbus* in 1849. John Buchanan, single, appears on the passenger list of the *Columbus*, not in 1849, but in 1852 on that vessel's first voyage to the colony.[1] Although Buchanan said that he immediately began collecting plants in the vicinity of Dunedin and sent them to 'W. D.' Hooker soon after his arrival in New Zealand, Dr Lauder Lindsay searched the herbarium at Kew and found that no Otago plants had been received between 1852 and 1862. He later wrote that 'several collections [of Otago plants] had been made and sent Home I am aware, but they were lost to science from not having been sent to the proper quarters for utilization.' (Lindsay 1868, p. 7).

As Lindsay had met Buchanan when visiting Otago in the summer of 1861–62, he may have known that Buchanan had sent his parcels of plants not 'to the

proper quarters', but to his old friend, Dr Ross of Busby. Ross's letters to Buchanan acknowledge packets of ferns and mosses received over a decade, some of which he passed on to the bryologist, William Wilson.[4] Ross considered Buchanan's collections to be important as he wrote in June 1867 on receiving J. D. Hooker's *Handbook of the New Zealand flora* saying 'I am sorry Mr Wilson was unable to undertake the revision of the N.Z. mosses as the Handbook would have been more useful to me and would have done more credit to your discoveries.'[5] Nothing is known of the fate of the material Buchanan sent to Ross who died in the early 1870s. If Buchanan retained duplicates, they are no longer recognizable except for a single gathering of *Macromitrium* made on Mt Cargill, Dunedin, in 1860.

During his first decade in New Zealand, Buchanan made several journeys into the botanically unknown hinterland of Otago when the Reconnaissance Surveys commenced in 1856. While on the Assistant Surveyor, Alexander Garvie's two major expeditions to the interior of the province in 1857 and 1858, the vegetation was noted as an aid to pastoral settlement.[6] Buchanan's observations on the unmodified grassland, forest, swamp and scrubland were incorporated in his classic essay, 'Sketch of the botany of Otago' (Buchanan 1869). It is difficult to believe that he did not make full collections on these expeditions, but according to Lindsay only fragmentary collections were made on the overland Reconnaissance Surveys owing to lack of time and materials (Lindsay 1869). If specimens from these inland and the later surveys of the coastal Otago Hundreds have survived, they no longer bear Buchanan's handwriting. It is possible that they have been re-labelled and dispersed in the herbaria of several Otago botanists [e.g. D. Petrie, B. C. Aston, W. Martin and A. Hamilton (WELT)] that contain specimens with the place names of the period, the most frequent being 'Interior of Otago'.

When Buchanan's employment on the surveys ended he was caught up in the gold fever that swept the province in the winter of 1861. His miner's right shows that he was on the rich Tuapeka field between September 1861 and September 1862.[7] He also prospected further inland on the Manuherikia River where he had found traces of gold while on the Reconnaissance Survey of 1858. Ross's letters mention plants received from these localities and that he was doing his utmost to further Buchanan's botanical career.

During 1861 it was announced in Britain that Dr James Hector M.D. had been appointed to undertake a geological survey of Otago. By a happy coincidence Ross had a patient who had been a college companion of Hector's in Edinburgh, and who immediately wrote to him on Ross's behalf recommending Buchanan as a prospective plant collector.[8] Ross also wrote to William Wilson asking him to put forward Buchanan's name to J. D. Hooker.[9] This Wilson did before Hector's departure for New Zealand. Many years later, on the day of Buchanan's death, Hector was to say that 'Sir Joseph Hooker had asked him to look out for a man named John Buchanan who had sent home to the herbarium at Kew the best collection of plants that were received from Australasia.' (Hector 1898). There were no such collections at Kew prior to Hector's departure from London, nor was Buchanan's name known to either Hooker or Hector before Ross's letters written on his behalf.

When Hector arrived in Dunedin in April 1862 he began selecting a small staff and in September, only a few weeks after the expiry of his miner's right, Buchanan was employed privately by Hector to collect bryophytes in North East Valley. In a letter to J. D. Hooker, Hector promised large and fully documented collections as soon as he could make Buchanan an official member of his geological survey team.[10] It was the collections that Buchanan made during Hector's two expeditions to the west coast that were so enthusiastically received at Kew. The first of these large collections from the west Otago mountains and lakes was very carefully annotated by Buchanan who also provided water colour studies of some of the alpine species and a vegetation map of the area. Later in 1863 Buchanan again journeyed inland to join Hector on the return voyage of exploration of Fiordland on the schooner *Matilda Hayes*. Although his collections suffered from mould in the constantly damp conditions Buchanan brought back at least six hundred species, including bryophytes.

In his official report Hector stated that 'the two expeditions to the West of the Province had yielded 4,500 specimens' and that, apart from those sent to Kew, a complete set had been retained to form a herbarium for the proposed Otago Museum (Hector 1864, p. 95). This important and substantial collection, as such, has entirely disappeared. It was described five years after Hector and Buchanan had left Dunedin as 'a collection of Lake District and West Coast plants' with 'the rarer plants represented by beautifully prepared specimens.' (Webb 1871, p. 204).

Nothing remains of Buchanan's three years of hard travelling and assiduous collecting, but specimens with the place names used by the Survey and the altitudes that Hector required to be noted have appeared in the herbaria of several botanists (mentioned above) who were in Dunedin in the 1890s. The collection of Otago plants made by Buchanan on the Otago Provincial Geological Surveys remained in Dunedin and was apparently re-labelled and distributed.

When Hector's contract to the Otago Provincial Government ended in 1865 he was appointed to found the Colonial Geological Survey and Museum in Wellington. All his Dunedin staff were transferred to the newly constructed Colonial Museum where Buchanan, as botanist and draughtsman, was responsible for building up the herbarium of indigenous plants. He thereby became the first and only botanist in the Colonial government service. During his twenty years' employment he collected in many parts of New Zealand, including the subantarctic Auckland and Campbell Islands, but not Macquarie Island as has often been stated. Much additional material was supplied by the geological field staff, private botanists and contracted collectors. By 1870, only five years after the Colonial Museum was founded, Thomas Kirk, the country's foremost botanist, referred to its copious herbarium (Kirk 1871).

The history of this herbarium is tragic for, by 1882, Buchanan was to write to T. F. Cheeseman, Curator of the Auckland Museum, that 'I had a very good collection at one time, but an herbarium that is open to

general plunder cannot long remain of much value.'[11] This attrition appears to have started almost a decade earlier; in 1875 Hector wrote from London to Walter Mantell, who was the Acting-Director, saying that he did not know what Kirk was doing in the herbarium as he had instructed Buchanan to keep the collection out of reach of everyone.[12] Yet Hector himself must have compounded the loss of material in order to maintain exchanges with overseas museums. In the same letter he asked Buchanan 'to look over the collection, take out what will be of use to our herbarium and send the rest to me by post.' He was asking either for specimens from Buchanan's current field work or for material that Kirk had been paid to collect for the Museum. But, whatever appropriations Kirk made on this or other occasions, they were fortunate as he relabelled the specimens and incorporated them in his well maintained herbarium which is now the major source of localized and dated specimens collected by Buchanan.

When Buchanan retired in June 1885 his position was not filled and in the following years the funding of the Museum and its ancillary functions became progressively more inadequate. Kirk's death in 1898 left Wellington without a botanist of note and, by the time Augustus Hamilton succeeded Sir James Hector as Director in 1903, the herbarium was in ruin. Hamilton was to describe to Cheeseman the bad state of the collection and the 'bucketful of grubs' he had swept up in an attempt to salvage the herbarium.[13]

Sixteen years later when Hamilton too had died, Donald Petrie was to add to the myth when he wrote about the Colonial Museum herbarium. He referred to its having been made up of 'the collections of Dr Hector and his assistant John Buchanan that possessed a special value for they contained duplicates of many of the specimens on which Hooker founded new species in working up the Handbook' (Petrie 1919, p. 261).

This was not correct. All the evidence indicates that the duplicates of the specimens sent to Kew from the Otago Geological Survey Expeditions remained in Dunedin. Joseph Hooker himself described to Hector, before the latter left Otago, how he had withdrawn the proofs of the *Handbook of New Zealand flora* in order to include the descriptions of new species and to augment the records of many other plants.[14] Moreover the inventories of the material Hector's staff packed for shipment to Wellington in June 1865 do not include any botanical collections, large or small.[15] In fact Hector expressed concern about the poor storage of the valuable Survey collections, including plant and bird specimens, that had been left in the damp Exhibition building in Dunedin.[16] Petrie was nevertheless correct in describing at some length the neglect of the Colonial Museum herbarium or what, by then, remained of it. He wrote that 'the specimens were not poisoned neither were they kept in boxes or in tightly wrapped parcels. Left lying on loose sheets of paper on open shelving the specimens fell an easy prey to moths and the whole tribe of small, destructive insects. . .' (Petrie 1919, p. 261).

The destruction of the herbarium through the ravages of insects, mice and damp was to continue as the old, wooden Museum became more derelict.[17] Fortunately some tightly wrapped parcels labelled by Buchanan did survive, indicating that the herbarium had been better curated in his time. Moreover, a Director's report made long before Buchanan retired, mentioned that specimens were being mounted in books (Hector 1873).

This statement is important as it appears to explain the existence of the twenty one guardbooks, known as the Buchanan Herbarium, held by the Otago Museum from 1898 and now deposited by the Trustees of that Museum in the herbarium of the National Museum of New Zealand (WELT). While at the Colonial Museum, Buchanan made up some of these guardbooks in which the plants were mounted in systematic order or, in some instances, by locality e.g. Chatham Islands or Subantarctic Islands. In 1906 Augustus Hamilton informed Cheeseman that he had found 'seven book volumes of Buchanan's plants' in a cupboard.[13] Only one of these books has survived from the Colonial Museum herbarium, the book of grass specimens that Buchanan nature printed for the folio edition of his *Indigenous grasses of New Zealand* (Buchanan 1877–1880).

The remainder were dismantled and the torn out pages, only recognizable by Buchanan's distinctive handwriting, dispersed throughout the herbarium. Most have the briefest of localities, e.g. Tararua Mts, Nelson, Kawau Is., and few are dated. When he retired to Dunedin, Buchanan was to continue to make up these plant books. Much of the material he used, including type or unique specimens, could only have come from the Colonial Museum, collected, described or recorded while Buchanan was in Government service.

All his work in arranging these plant books was wasted for, although he named the species, he rarely provided a locality or date. For example, of the seventy two separate specimens of native orchids, none are dated and only five are localized. Why he chose to disregard Hector's requirements for well annotated specimens is difficult to understand for, in doing so, he compounded the loss of what was New Zealand's first officially constituted herbarium. For forty years Buchanan served the enthusiastic recipients of New Zealand plants in Britain and carried out Hector's desire to provide the colony with a representative herbarium. He lived to see his efforts fragmented and neglected, but paradoxically, he diminished the value of the very material he saved from destruction by failing to label the collection.

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I acknowledge the pleasant exchange of information by letter and conversation with the late Professor David Saunders, of Adelaide, Buchanan's great nephew.

Notes

1. Report of the arrival of the barque *Columbus* at Port Chalmers. *Otago Witness* 21 February 1852: 2.
2. Register Births, Deaths and Marriages, Dunedin.
3. 'Men of note in Otago.' *Otago Daily Times* 12, 19, 26 September 1895.
4. Letters from J. Ross to Buchanan, dated 9 May, 21 May, 11 June 1860. (Buchanan papers, Mitchell Library; photocopies in Alexander Turnbull Library).
5. Letter from J. Ross to Buchanan, dated 15 June 1867. (Buchanan papers, Mitchell Library).
6. Garvie, A. (1857–1859). Unpubl.'Journal of a Reconnaissance Survey of part of the Province of Otago...' Field books 50B, 51, 69. (Department of Lands: Dunedin).
7. Miner's Right No. 1735 issued to Buchanan for the Tuapeka District from 11 September 1861 to 10 September 1862 (Colonial Museum papers, National Museum, Wellington).
8. Letter from J. Hector to Patrick Graham, dated 25 October 1861 (Buchanan papers, Mitchell Library).
9. Letter from J. Ross to Buchanan, dated 18 November 1861 (Buchanan papers, Mitchell Library).
10. Letter from J. Hector to J. D. Hooker, dated 1 September 1862 (New Zealand Letters, 74: 410–413, Kew archives).
11. Letter from Buchanan to T. F. Cheeseman, dated December 1882 (Cheeseman papers, Auckland Institute and Museum).
12. Letter from J. Hector to W. B. D. Mantell, dated 3 August 1875 (Colonial Museum papers, National Museum, Wellington).
13. Letter from A. Hamilton to T. F. Cheeseman, dated 28 August 1906 (Dominion Museum 06/537, National Museum, Wellington).
14. Letter from J. D. Hooker to J. Hector, dated 18 January 1864 (Colonial Museum papers, National Museum, Wellington).
15. List, R. B. Gore, undated, c. mid. 1865 (Colonial Museum papers, National Museum, Wellington).
16. Letter from J. Hector to the Otago Provincial Secretary, dated 2 September 1866 (Colonial Museum papers, National Museum, Wellington).
17. Letter from J. M. McDonald to G. Ball, dated 10 December 1918 (Dominion Museum 2/4/80, National Museum, Wellington).

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A comparison of the approach to taxonomic botany by T. F. Cheeseman and L. Cockayne

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Abstract

Cheeseman (1846–1923) and Cockayne (1855–1934) were New Zealand's most notable botanists though dissimilar in their botanical interests, outlook, and philosophy. Cheeseman's contributions to taxonomy were based on traditional 19th and early 20th century plant taxonomy applied with skill and dedication and emphasized the herbarium. Cockayne's interests in botany included taxonomy but embraced the developing fields of ecology and evolution. In later years his discovery of widespread hybridization in the New Zealand flora had a major impact on his views on taxonomy.

In published statements Cockayne, somewhat irrationally, ridiculed traditional taxonomy with its emphasis on herbaria. However, he clearly understood the importance of herbaria as shown by his autobiographical manuscript notes and well prepared herbarium specimens.

The studies of Cockayne and Cheeseman were complementary. Cockayne's field observations were monitored and authenticated by Cheeseman; Cockayne provided Cheeseman with important field observations for his *Manual* as well as personal encouragement for his work.

Leonard Cockayne (1855–1934) and Thomas Cheeseman (1846–1923) are New Zealand's most notable botanists. They are both clearly associated with New Zealand and could be considered dinkum kiwis though they were born in England — Cockayne near Sheffield and Cheeseman in Hull. They differed in their background, research interests, and personality. Cockayne was 26 when he arrived in New Zealand via Australia whereas Cheeseman was a child of six and was educated in New Zealand.

These two great botanists rarely met, the first occasion probably in 1904 and although close collaborators they never published a joint paper. However, Cockayne did contribute to Cheeseman's *Manual* including an item on hybridism in *Nothofagus* (Cheeseman 1925, p. 373).

The best evidence for a close rapport between Cockayne and Cheeseman come from their 62 letters between 1898 and 1922 which are retained at the Auckland Institute and Museum Library (file C52).

Considering Cheeseman's important status in New Zealand botany and his honoured place as a founder of the Auckland Institute and Museum, it is regrettable that a full account of his life and work has not been published. This paper presents a discussion on the approach of Cheeseman and Cockayne to taxonomic botany with the former representing the late 19th and early 20th century viewpoint and the latter an advocate of new concepts in taxonomy.

A comparison of the publications of Cheeseman and Cockayne

The publications of Cheeseman (Cheeseman 1925, pp. xli-xliv) and Cockayne (Thomson 1982) reflect their different contributions to science. There are striking quantitative and qualitative differences between the two. Whereas Cockayne's publications were virtually restricted to botany, Cheeseman published on both plants and animals and some ethnology as befitting a museum curator. However, within the field of botany Cheeseman's interests were much more restricted than Cockayne's. A large portion of his publications dealt with taxonomy and plant distribution. Much of Cockayne's published work was related to ecology, plant distribution and vegetation surveys (Thomson 1983a) with a smaller proportion of taxonomic work. Cockayne published on a much greater range of topics within botany than Cheeseman, and in addition was more international in his approach and published in 16 overseas journals (Thomson 1983a), whereas virtually all Cheeseman's publications were in *Trans. & Proc. New Zealand Institute.*

Aspects of the personalities of Cockayne and Cheeseman

Evidence from many sources indicates that Cockayne and Cheeseman had quite different personalities. The published record, letters and reminiscences from friends and colleagues indicate that Cockayne had strong views, perhaps sometimes tending to the unreasonable on all manner of subjects. He seemed to delight in giving his opinion on his associates. In fact A. W. Hill, in the diary of his visit to New Zealand, commented, 'His [Cockayne's] chief weakness is his tendency to belittle the work of other N.Z. botanists, not directly working under his wing — such as Oliver [W. R. B. Oliver, 1883–1957] for instance — his intolerance somewhat unfortunate as it is coupled with some vanity as to what he has done himself' (Hill 1928, p. 283; (C) RBG Kew). Cockayne's apparently abra-

sive personality did not truly reflect his sensitive and generous character though the abrasive side was often more evident (Wall 1965).

In addition to his often boisterous attitude coupled with downright rudeness on occasion, Cockayne also had a great ability to pamper and this characteristic is shown in his relationship with Cheeseman.

Cheeseman was in many ways opposite in personality to Cockayne and I can best quote from Dr W. R. B. Oliver's undated and unpublished biography of Cheeseman:

> Those who new Cheeseman personally will not readily forget his pleasant and amiable manner, his courtesy, his readiness to give his time to their enquiries and his generosity in giving the best of his wonderful fund of knowledge to help those who applied to him. He was a true servant of the people always ready to help those in search of knowledge. In spite of the great breadth of his learning he was modest and unassuming and worked unselfishly for the benefit not only of Auckland, but, through his writings for all New Zealand.

Professor A. P. W. Thomas (1857–1937) is cited by Oliver as commenting that 'Quiet and unassuming in manner, he received visitors with kindly courtesy, and seemed to take a delight in satisfying the frequent appeals for information on scientific subjects'. Oliver further comments, 'In spite of an exceedingly busy life Cheeseman spared time for friendships that were treasured by many . . . Always considerate of everyone whatever his position in life, Cheeseman was much respected by those whom he employed. . .Cheeseman seldom said a word of disparagement about anyone even though his own work was affected.'

Co-operation between Cockayne and Cheeseman

The letters from Cockayne to Cheeseman clearly show that the botanical studies of these two New Zealand botanists were complementary and that they co-operated very closely. Cockayne forwarded specimens and data on plant distribution which added precision to Cheeseman's taxonomic and distribution data, etc. Cheeseman (1906) acknowledged Cockayne's assistance in the introduction to his *Manual*. Cheeseman monitored specimens collected by Cockayne during his surveys and made numerous identifications for him.

It was Cockayne who had established the tenor of this close co-operation long before he was a recognized botanical leader in New Zealand. In his first letter to Cheeseman on 26 August 1898 he sent 22 lantern-slides illustrating New Zealand vegetation and offered to help Cheeseman 'all in my power' with the preparation of the *Manual* (Cheeseman 1906). Cockayne, in his letter of 14 May 1900, clearly states he is not enamoured of describing plants but generously offers his plants to Cheeseman for publication, 'Of course you can publish any of my plants, if they are new and at any time. I am not at all anxious to publish new species myself, nor am I at all wedded to any of the names I have provisionally given them only it is useful to have something to call them by'. In the next 22 years until Cheeseman's death in 1923 Cockayne upheld his promise to assist. As important as the co-operation in botanical matters was the encouragement and sustenance Cockayne provided to help Cheeseman complete the *Manual*. In my view, without Cockayne's encouragement at critical times, the *Manual* may have languished; there were times when the pressure of administrative chores seemed to be burdensome to Cheeseman (Cheeseman's letters of 19 February 1922 and 12 July 1922). Thus we are indebted to Cockayne not only for providing botanical knowledge to Cheeseman but also for nurturing Cheeseman's enthusiasm for his botany. In this way Cockayne showed himself to be a leading motivator in New Zealand science. He called it imparting the holy fire of enthusiasm. In the case of Cheeseman I suspect Cockayne, with his references to an F.R.S. for Cheeseman (Cockayne's letters of 6 March 1921 and 29 March 1922), would have helped give Cheeseman a fillip when his life was coming to a close. It was surprising that Cheeseman was not proposed earlier for an F.R.S. and it was an honour that did escape him (Cockayne 1923).

Cheeseman reciprocated Cockayne's encouragement and this no doubt sustained Cockayne in his own labours with *The vegetation of New Zealand* (Cockayne 1921) though perhaps Cockayne may have been more self-motivated.

The co-operation between the two was maintained despite Cockayne's unabated campaign against what he saw as the shortcomings of traditional taxonomy (see below). This did not seem to interfere with their co-operation though Cockayne's comments in publications must have taxed Cheeseman's good nature. However, some, though not all, of Cockayne's most strident and direct criticism of the current taxonomic practices came after Cheeseman's death in 1923. Cockayne's criticism became more evident in 1921 after his discovery of polymorphism suggesting hybridism in *Nothofagus* (e.g. Cockayne & Atkinson 1926).

Others have commented on the relationship between Cockayne and Cheeseman, including E. Phillips Turner (1865–1937) a noted early New Zealand botanist, forester and conservationist. He suggested in a letter of 5 February 1936 to J. C. Andersen (1873–1962) that Cockayne and Cheeseman were rivals (Thomson 1988). This assessment I believe was mischievous and misleading and failed to recognize the close co-operation between the two. Phillips Turner did seem rather disgruntled at the time he wrote the letter.

Although Cheeseman was relatively formal but friendly and polite in his letters to Cockayne he did on occasion give gentle but firm reprimands. One example was when Cockayne proposed the name *Cheesemania* for *Olearia insignis* to honour Cheeseman (Cockayne's letter of 29 March 1922 and Cheeseman's reply of 14 April 1922; Thomson 1979a). Cheeseman's *Pachystegia* prevailed.

Elements of the attitude of Cockayne and Cheeseman to plant taxonomy

Cheeseman represented what might be referred to as the traditional approach to plant taxonomy in the 19th and early 20th century. He applied this approach with skill and dedication and the herbarium played a central role.

Cockayne, on the other hand, campaigned against what he saw were the inadequacies of taxonomy based solely on the herbarium. Regarding herbaria Cockayne seemed to have a 'bee in his bonnet'. His vigorous and

sometimes florid language when discussing herbaria has been recorded in publications and in his letters (Thomson 1979b, 1980) and we can but imagine his sweeping and uncompromising language in discussions with botanists and anyone willing to listen. He seemed to link herbaria to what he referred to as 'the hoary old taxonomy'. He made this comment in annotations on a reprint of his paper with Allan *The present taxonomic status of the New Zealand species of Hebe* (Cockayne & Allan 1926): 'With the joint compliments of the authors to one another in the first attempt to drive a nail in the coffin of the hoary old taxonomy — the misleader, the vicious!'.

Cockayne, early on in his correspondence with Cheeseman, proclaimed his lack of interest in herbaria. In sending specimens of *Pimelea* from his herbarium to Cheeseman on 28 July 1902 wrote, 'but remember you are to keep all such as long as they may be of service to you. Indeed I really care very little for my private herbarium and look upon it as a necessary nuisance'. Cockayne's apparent lax approach regarding the retention of herbarium specimens was in contrast to the attitude of Cheeseman and would be unacceptable today. I say apparent lax approach because despite his talk he did retain well prepared and fully labelled herbarium specimens. In his letter of 29 June 1920 to Cheeseman, Cockayne wrote, 'I fear that types of all my species etc., are not available. Some of the descriptions were drawn up from material in my garden, which, in all cases, was not turned into herbarium specimens'. Cockayne, from when he first decided to study New Zealand plants, made observations on plants in the field and in his Tarata Experimental Garden at New Brighton, near Christchurch. Although Cheeseman also made extensive field observations, especially in the north of New Zealand, as far as I know he did not use the experimental garden, and the herbarium played a central role in his botany. Cockayne, from the 1920s up to the time of his death on 8 July 1934, developed the Otari Open-Air Native Plant Museum near Wellington as the culmination of his approach to botany. It is appropriate that both Leonard and his wife Maude are buried there.

Cockayne's apparent dislike for herbaria was based on the admirable view that plants should be observed growing naturally in the field and in the experimental garden rather than observing them entirely in the dried condition in herbaria. I suppose this viewpoint is now generally accepted.

As early as 1906, in the newspaper articles which formed the basis of his classic book *New Zealand plants and their story* (Cockayne 1910), Cockayne gave his general view of herbaria: 'Previously the one object of a field botanist, no matter how well the flora of a region was known, was usually to collect specimens, dry them and store them away in a herbarium, whose dried and most unnatural contents were available for study. But such profitless work is being superseded. Plants are now being studied as living organisms' (Cockayne 1906). I have noted that this statement was not included in his book, perhaps better counsels prevailed (Thomson 1975). Later, in 1927, Cockayne and Allan, after much study and field observations especially in the light of Cockayne's discovery in 1921 of polymorphism in *Nothofagus* (Cockayne & Atkinson 1926), criticized what they called the 'artificial' or 'herbarium taxonomy' of the past and compared it with what they called the 'natural' or 'field taxonomy'. This paper included a direct criticism of the taxonomic approach of Cheeseman in the second edition of the *Manual* (Cheeseman 1925) though they were mindful of the pioneer contributions of Cheeseman, J. D. Hooker and T. Kirk. Cockayne and Allan concluded the 1927 paper with a plea, 'And would that new workers, free from the thraldom of the dangerous herbarium artificial method, would come forth'.

Despite these and similar derogatory statements about the 'herbarium taxonomy' Cockayne did understand the proper use of herbaria and I believe this is best illustrated by his own comments in his unpublished manuscript autobiography *The little boy in the English wood* (Thomson 1983a). These autobiographical notes were written just before Cockayne died. The factors which influenced Cockayne's resolve to study New Zealand plants (Thomson 1983b) are discussed in the autobiographical notes: after mentioning the importance of G. M. Thomson's book (1882) on New Zealand ferns, and the Featons' (1889) book, Cockayne writes, 'Still better he [Cockayne] became aware of the Herbarium of New Zealand plants in the Canterbury [Christchurch] Museum, each species bearing in the handwriting of Thomas Kirk its scientific name'. This is an unequivocal statement by Cockayne on the importance of herbaria.

Coupled with his views on herbaria, Cockayne also spoke often and also in florid terms on nomenclature and priority. Thus, on 5 April 1932, he wrote to Dr Lucy Cranwell, 'I have been appointed a member of the International Committee on Botanical Nomenclature — me a botanical bolshevist! Perhaps I may do something to stay the hands of those who desire priority at all costs and no matter how idiotic'. And in his *Hebe* paper (Cockayne 1929) he propounds a reasonable argument for stability in nomenclature and then for emphasis finished with a typical Cockayne flourish and thrust, 'But, for the future, should I stumble upon an ancient specific name, so far as I am concerned it will remain buried until perchance some botanical Frankenstein should rashly breathe life into the inert and harmless body'.

Cockayne, in letters to Cheeseman as early as 20 April 1902, did emphasize the problem of intermediate forms in the New Zealand flora, e.g. *Hebe*, and the problem this posed for Cheeseman's *Manual* (Cheeseman 1906). Thus, this problem was evident to Cockayne many years before his 1921 discovery of polymorphism suggesting hybridism in *Nothofagus*, a discovery which triggered his search for, and recognition of, hybrids in many genera after he developed the 'hybrid eye' or 'hybrid mania' (Cockayne & Allan 1934). Cheeseman did include in the second edition of his *Manual* Cockayne's note about *Nothofagus* hybrids (Cheeseman 1925). Perhaps Cheeseman did not fully accept Cockayne's records of hybrids. Cockayne *et al.* (1932), when discussing hybrids between *Ranunculus buchananii* and *R. lyalii* wrote: 'Two plants of the hybrid group much like one another were described by Cheeseman as species under the name *R. matthewsii*, for he had no idea of the great polymorphy of this hybrid group as now known, nor did the idea of hybridity occur to him. So great is the polymorphy that any herbarium botanist working with a few individuals

from different parts of the group might quite well decide to "create" several distinct species' (Cockayne *et al.* l.c., p. 34).

Perhaps the best summary of Cockayne's viewpoint on taxonomy and herbaria is given in his letter on 29 March 1927 to Dr J. S. Yeates (Thomson 1979b) who had been an early student of plant cytology in New Zealand. Cockayne wrote:

> It is clearly appearing that so far as herbarium 'types' go, they tell nothing, for no one from a dried specimen can do more than make a guess at its taxonomic status, unless he has a great amount of carefully-collected material, each specimen, or set of such, taken from a single plant, supported by copious field-notes as to the individual status of such plants. Such material was never collected by any person sending material to Kew during the preparation of Hooker's New Zealand floras — and, for that matter, herbarium material in general is nearly always quite inadequate — so that but little can be learnt from the Kew Herbarium (or any Herbarium), except that those plants can be seen which Hooker dealt with. Generally the 'new species' of the *Handbook of the New Zealand Flora* — just as many of those described by Cheeseman and Petrie — were based on more than one specimen, which did not match one another, and the description referred not to any one plant, but was an imaginary conception based on the entire lot. Obviously, an abstraction not existing in nature can have no 'type'.

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The lean legacy of freshwater phycology in Victoria

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Abstract

An ideal floristic legacy would entail: 1) the preservation and accessible storage of suitable voucher specimens, 2) the accurate description and illustration of taxa, and 3) the classification of these entities into a coherent taxonomic system. All three aspects are generally absent from the published records of freshwater macroalgae from Victoria. To illustrate this, the problems associated with archival preservation and the classification of macroalgae are outlined, followed by a brief history of the collectors. Against this background, the attempts of Henry Watts (1828–1889), Alfred Hardy (1870–1958) and Heinrichs Skuja (1892–1972) to capture the macroalgal flora of Victoria for perpetuity are evaluated. Although Skuja, a professional freshwater phycologist, died leaving a trail of red algal manuscript names throughout the world's herbaria, he produced an elaborate description of a new genus and species from the Yarra River. The naturalists Watts and Hardy seldom achieved all three aspects of a good legacy. Their distributional data for genera has some historical value, but as most of their specific determinations of macroalgae cannot be confirmed, the legacy is of limited scientific value.

Inland Victoria has a diverse abundance of algal habitats; wherever there is water, no matter how transient, there are algae present. On the other hand, collectors and collections of these algae have been rare.

In this paper, I discuss the major collectors and chroniclers prior to 1939, of Victorian freshwater algae (the Charophyta have not been considered here, since they are usually included in aquatic phanerogamic floras and seldom reported in algal surveys). In particular, I focus on the macroalgal flora and its three main exponents: H. Watts, A. D. Hardy and H. L. Skuja.

Macroalgal taxonomy and preservation

For convenience, algae can be divided into the microalgae — which are often planktonic — and the macroalgae — which are visible in the field and usually attached to the substratum. Unlike Australian terrestrial and marine floras, most freshwater macroalgae seem to be cosmopolitan. The freshwater macroalgae range from unbranched filaments (e.g. *Klebsormidium* Silva, Mattox & Blackwell, *Spirogyra* Link), through branched filaments (e.g. *Cladophora* Kützing, *Stigeoclonium* Kützing) or branched siphons (i.e. with no cross walls; e.g. *Vaucheria* DC.), to more complex arrangements of whorled laterals (e.g. *Batrachospermum* Roth). All major divisions of algae are represented, but the Chlorophyta are most common. Most genera are distinct and can be identified in the field by an experienced collector. In some genera (e.g. *Cladophora*, *Klebsormidium*, *Batrachospermum*), species are characterised by vegetative or reproductive features usually visible in field material. In other genera (e.g. *Oedogonium* Hirn, *Spirogyra*, *Vaucheria*), reproductive features are of prime taxonomic importance, but many populations (particularly those from flowing water) are often sterile. In *Stigeoclonium*, recent taxonomic revisions utilize the germination mode of zoospores and the morphology of the prostrate system, neither being visible in naturally growing plants, to distinguish species. The identity of many macroalgae, therefore, remains obscure unless collecting has been fortuitous or plants are grown in culture.

Some of the specific characters remain in dried plants, while others are only retained in wet or slide material. Fresh material must be examined to reveal intracellular cell details, such as chloroplast shape or the presence of contractile vacuoles.

Macroalgae are best preserved as a permanent slide — e.g. mounted in corn syrup, which sets relatively hard, or in sealed glycerol — or in a liquid fixative. If the preserving solution contains some glycerol then the features will remain useful even when the liquid has evaporated. In any case, a dried specimen in a jar is often as good as, or sometimes better than, one absorbed into a piece of paper. A solution of formalin, acetic acid, alcohol and glycerol gives better preservation of features and less dissociation of cells than the commonly used 4% formalin. An air-dried specimen in a cellophane bag usually is the best way to store dried material, but plants pressed onto absorbent paper may be useful where their gross morphology is taxonomically important. So, plants *can* be preserved for a very long time. In most cases, however, good illustrations and descriptions of fresh or wet-preserved material provide an adequate (and often better) substitute.

Taxonomic legacy

For freshwater macroalgae, as for all plants, there seem to be three aspects of an ideal floristic legacy. Few older treatments would have them all, but at least one of these features is needed: 1) plants should be pre-

served for posterity, with full details of their collections, 2) the specimens should be described and illustrated so that similar plants can be recognized in later collections, and 3) the taxa described should be referred to a universal classification system that shows their relationships with other taxa. Few published accounts of freshwater algae from Victoria achieve any of these features.

The beginnings of freshwater algal studies in Victoria

In the frontier days of freshwater algal collecting late last century, as also today, Australia was very much the poor cousin of New Zealand (Sarma 1986). Both countries lagged well behind both North America, where several extensive floras had been written (Wood 1872; Wolle 1887), and Europe, where, in addition to many floras, the higher classification was being reconsidered (e.g. Rabenhorst 1868; Hansgirg 1886, 1888, 1892) and detailed morphological and life-history studies had commenced (e.g. Pringsheim 1855; Klebs 1892).

The most thoroughly collected area in Australia during that period was Queensland (Bailey 1893, 1895, 1898, 1913). Most algae recorded by Bailey were identified and first published by European phycologists, such as Oskar F. A. Borge (1911), Martin A. J. Möbius (1892, 1895) and Wilhelm Schmidle (1896). The remainder of Australia was left to the sporadic collections of naturalists, phanerogamic botanists or the occasional inland foray of a marine phycologist. Up until recently, no specialist freshwater phycologist had been employed by an Australian or State Government: lately, some universities have supported freshwater algal studies to a limited extent.

The earliest remaining specimens of freshwater algae from Victoria, held in the National Herbarium of Victoria (MEL), were collected by Ferdinand J. H. Mueller soon after he arrived in Melbourne: *Oedogonium*, from ponds near the Yarra River in October 1852; and *Cladophora*, from the Darebin Creek in January 1853. These were identified by Otto W. Sonder and Theodor Reinbold in Europe; Sonder (1852, 1880, 1881) included these genera in his records of algae from Australia. Thirteen years later (Table I), Henry Watts produced the first list of freshwater algae from Victoria.

Henry Watts (1828–1889)

In the early 1860s, Henry Watts collected marine algae from the drift around Warrnambool and sent them to William Harvey in Ireland (Ducker 1983, 1988). Harvey included these plants in his *Phycologia australica* (1858–1863), naming two species in appreciation of Watts's enthusiasm. Watts also collected freshwater algae from near Warrnambool, and later, Ballarat and the Yarra River basin (mainly the lower reaches of the Yarra River and in the water supply from Yan Yean).

He was interested in all aspects of microscopy. Towards the end of his life, when living in Collingwood, he became involved with the Field Naturalists Club of Victoria (F.N.C.V.) (as librarian, vice-president and committee member), giving talks on various topics of natural history (McCoy 1883). In 1865, Watts published his first list of freshwater algae in the *Transactions and Proceedings of the Royal Society of Victoria*. Each record included the names of the waterbody and nearest town. Watts did not give authorities for the names, nor his sources for their identification, but all the desmids can be found in *The British Desmidieae* by Ralfs (1848) and the remaining taxa in *The history of the British freshwater algae* by Hassall (1845).

Some of his collections were later given to Mueller, who sent them to Friedrich T. Kützing and C. F. Otto Nordstedt in Europe for identification (Kützing 1882, unpubl.; Nordstedt 1886, unpubl.). Watts published a revised list of freshwater algae in the *Victorian Naturalist* in 1887, this time without any locality details. The names used were from the determinations of Kützing and Nordstedt, or taken from *The freshwater Algae* by Cooke (1884). In the introduction to his 1887 list, Watts mentioned both Cooke (1884), and *A contribution to the history of the freshwater algae* by Wood (1872), as texts he had seen. Hardy (1905) reported that in an unpublished, undated manuscript, Watts stated that he had never seen a species that could not be identified using Ralfs (1848) or Wood (1872).

There were three other publications by Watts that concerned the freshwater algae: a description of a collecting trip to Mt Macedon (Watts 1883), a record of *Oedogonium tenellum* Kützing and associated algae from near Berwick (Watts 1884), and a list of algae found in ponds at Oakleigh (Watts 1886). Again, none of these publications included the source of each identification.

There is little other information available on Henry Watts, and he seems to have died in 1889 without any family or close friends (Death Certificate 1889). His occupation had been reported (Sands & McDougall 1871–1889) as a 'bootmaker', a 'perfume manufacturer', a 'preparer of microscopical objects', and, finally (Inquest Proceedings 1889), as a 'lunatic'. Sadly Watts spent the last year of his life in the Yarra Bend Lunatic Asylum, suffering from dementia and paralysis.

Watts's published legacy consists of two lists of algae and a few scattered records. Although most of his microscopic specimens were lost during his illness (Anon. 1890), some of his algal collections are represented by dry voucher specimens in MEL. None of these, however, has any details of collection beyond a number whose meaning is now obscure (e.g. Fig. 1a). Hardy (1905), felt that the lack of authorities for names detracted from the usefulness of Watts's lists. (Ironically, none of the lists sent by Kützing and Nordstedt to Mueller included authorities, so Watts was not set a good example). Of more importance in a floristic treatment, however, is the basis for each identification, i.e. the literature used and the features considered important. None of this information is given, and specific concepts in some genera vary widely between authors.

The plants in Watts's lists identified by Kützing (Watts coll. nos 3–41, 72–95) and Nordstedt (Watts coll. nos 102–143) can be traced from the letters sent to Mueller. Only 16 of the 42 macroalgal names listed in Watts (1887), however, were provided by these two specialists. So all of the 1865 list, and over half of the 1887 list of macroalgae, were determined using published floras from Europe and America. The circum-

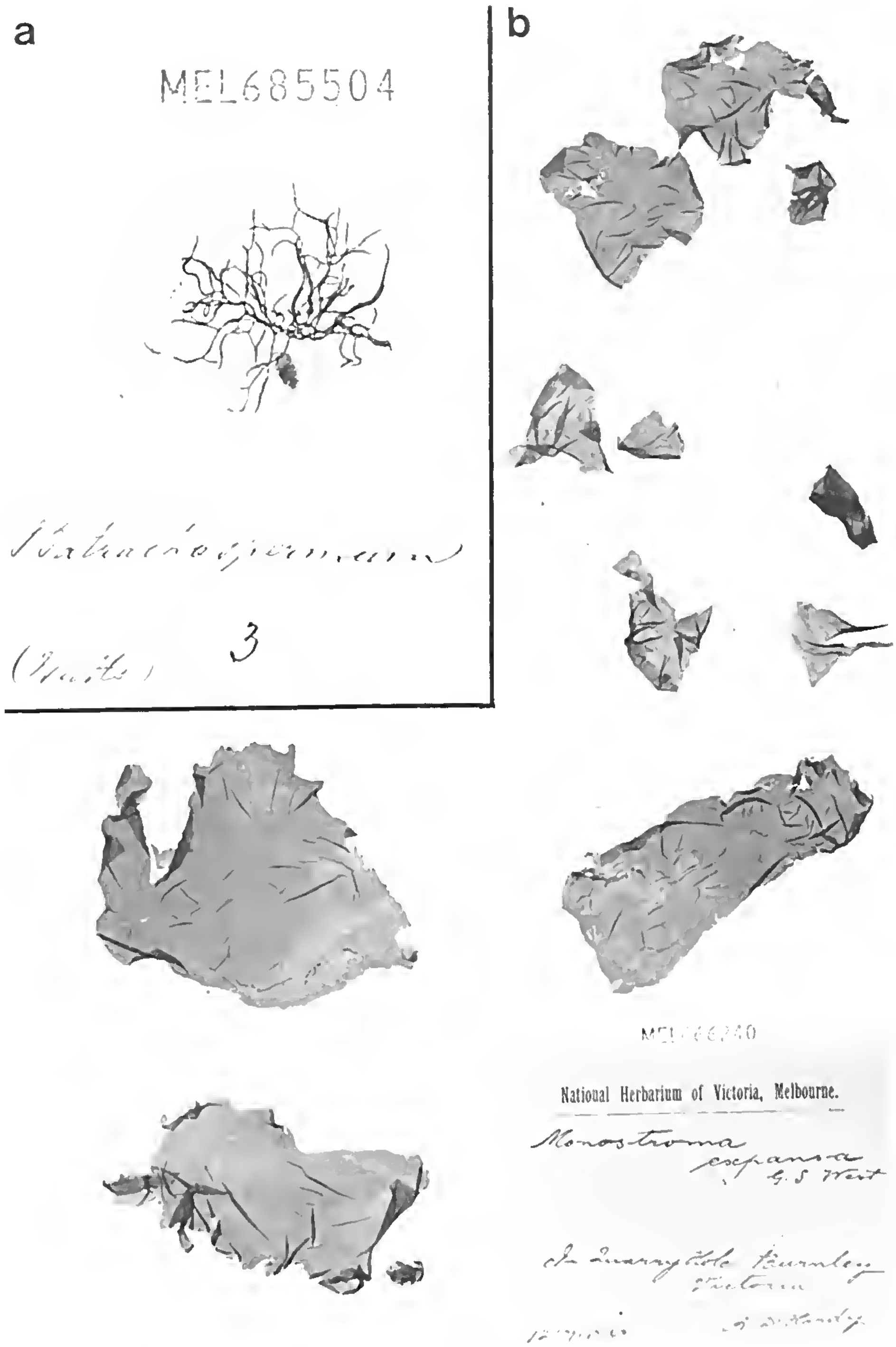

Fig. 1. **a** — Isotype of *Nothocladus nodosus* Skuja (*Watts 3*, MEL 685504; x 0.9. **b** — Syntypes of *Monostroma expansa* West (*Hardy s.n.*, MEL 666240; x 0.4.

scription of species by these early authors (including Kützing and Nordstedt) do not always match current specific concepts (many of Kützing's species of *Spirogyra*, for example, were based on vegetative plants), and there is no indication of how closely Watts followed any taxonomic system.

If preserved material is extant, some identifications can be verified. Of the 21 specimens of macroscopic freshwater algae (excluding Cyanophyta) collected by Watts and held in MEL, only 12 can be tentatively identified to their species. The rest are sterile *Oedogonium*, field material of *Stigeoclonium* and a *Batrachospermum* with poorly preserved reproductive features. Only one, the type of *Nothocladus nodosus* Skuja, was ever fully described and/or illustrated. Watts's collection of slides seems to have been lost or destroyed (Microscopical Group, F.N.C.V., pers. comm.), and even the parts of it that remained until early this century were not in good condition (Hardy 1905). It seems, therefore, that most of Watts's records for species of macroscopic freshwater algae must be considered useless.

His published records of genera, when supplied with a locality, can probably be accepted due to the comparatively well-defined generic limits of freshwater macroalgae. His record of *Nothocladus nodosus* from the Yarra River in Collingwood is interesting, since the type locality 100 years later is polluted and muddy. To find this species today, one must travel 80 km upstream, to sites with a water quality presumably similar to that found in Collingwood a century ago.

In spite of this lean scientific legacy, Watts should be remembered as the pioneer of freshwater phycology in Victoria. His work with these organisms was hindered

Table I
Collectors of published records (prior to 1939) of freshwater algae in Victoria*

Collector	Localities	Published
Mueller, F. J. H. (1825–1896)	Widespread	Sonder (1852, 1880, 1881), Borge (1896).
Watts, H. (1828–1889)	Warrnambool, Ballarat, Melbourne	Watts (1865, 1883, 1884, 1886, 1887), Skuja (1934).
Gibbons, S. (fl. 1868–1869)	Yan Yean, Melbourne	Gibbons (1874).
Shephard, J. (fl. 1890–1903)	Melbourne environs	Shephard (1891, 1896), Shephard *et al.* (1918a, 1918b).
Berggren, S. (1837–1917)	Fernshaw	Nordstedt (1887, 1888).
Grayson, H. (fl. 1892–1903)	Ballarat, Geelong, Melbourne	Grayson (1892).
Stickland, W. (fl. 1894–1899)	Melbourne environs	W. & J. Stickland (1895, 1896), W. Stickland (1897, 1898), Barnard (1899).
Eckert, I. P. (?J. P. 1861–1924)	Wimmera, Murray River	Borge (1896).
Lucas, A. H. S. (1853–1936)	Lake Wellington	Borge (1896).
Smith, W. I. (fl. 1889–1909)	Murray River	Borge (1896).
Barnes (?-?)	Ovens River	Borge (1896).
Luehmann, J. G. (1843–1904)	Dandenong	Borge (1896).
d'Alton, St E. (fl. 1896–1903)	Wimmera	Borge (1896).
Campbell, F. (fl. 1886–1887)	Australian Alps	Borge (1896).
Lauterbach, K. A. G. (1864–1937)	St Kilda	Schmidle (1897).
Tisdall, H. T. N. (1839–1905)	Western Port, Melbourne	Tisdall (1898, 1900).
Stickland, J. (fl. 1895–1934)	Melbourne environs	W. & J. Stickland (1895, 1896), J. Stickland (1913, 1918, 1920, 1923, 1924, 1929), Shephard *et al.* (1918b), J. Stickland *et al.* (1919).
Hardy, A. D. (1870–1958)	Melbourne and surrounds	Hardy (1904a, 1904b, 1905, 1906, 1907, 1910, 1911, 1913, 1936, 1938a, 1938b, 1943), West (1905, 1909).
Barnard, F. G. A. (1857–1932)	Mount Baw Baw	Hardy (1914).
Capra, G. (fl. 1908–1909)	Daylesford	De Toni & Forti (1922).
Phillipson, J. (fl. 1930–1935)	University of Melbourne, Heathmont (terrestrial)	Phillipson (1935).

* Most are isolated records and not comprehensive floras of the localities. There are undoubtedly further incidental records of freshwater algae published by the Field Naturalists Club of Victoria and the Royal Society of Victoria.

by limited assistance from trained phycologists and access to the relevant literature. Nevertheless, he explored the creeks and ponds of Victoria for the first time, and opened the freshwater algal account for Australia.

Few other collections of freshwater algae were made during this period (Table I). In 1868, Sydney Gibbons compared the water quality of the Yan Yean Reservoir with that of Melbourne's drains and sewers. He provided illustrations of the phytoplankton (Gibbons 1874, figs 1–5), and identified a few desmids to species level. In 1875, Sven Berggren collected some macroalgae from in and around the Watts River (named after George Watts, c. 1843, apparently no relation to Henry Watts) at Fernshaw. These were identified by Nordstedt and published with further collections by Berggren from the Blue Mountains (New South Wales) and New Zealand (Nordstedt 1887, 1888). Borge (1896) published a list of algae (some with descriptions and illustrations) sent to him by Mueller. These were primarily collected by naturalists.

There were some incidental records of freshwater algae (mostly microalgae) in the *Victorian Naturalist*, none of which can be verified, and a few collections made in 1899 and 1900 by Richard A. Bastow (1839–1920), held in MEL but not published. Most of the records by the Sticklands (Table I) were incidental in accounts of the animal life in ponds. No major work was done until the start of the next century.

South-eastern Australia was then served by two keen and industrious, honorary phycologists: George I. Playfair in New South Wales (see Tyler & Wickham 1988), and Alfred D. Hardy in Victoria.

Alfred Douglas Hardy (1870–1958)

Alfred Hardy worked with the Forest Commission, mainly as a draftsman and botanical officer, until his retirement in 1936. (A photograph of Hardy will be included in a forthcoming publication by P. A. Tyler & H. U. Ling, University of Tasmania.) Hardy's amateur studies ranged from the tallest trees to the very smallest forms of plant life. The freshwater algae soon became his speciality. In 1909, he was appointed 'honorary algologist' with the Melbourne & Metropolitan Board of Works (M.M.B.W.) and he remained in that position until his death. In later years, however, he did receive 'a fee paid in advance . . . for services rendered' (Hardy 1957, unpubl.).

While working for the M.M.B.W., Hardy produced firstly six-monthly, then quarterly reports on the algae growing in the water bodies controlled by the board. These reports (Hardy 1931–1955, unpubl.) were usually about two pages long, and would include a list of the algae found in the various reservoirs and a summary of conditions at the time. Sometimes simple drawings were included alongside the species listed.

Before being appointed as an honorary algologist with the M.M.B.W., Hardy had already collected from most of the reservoirs around Melbourne. He sent numerous collections to George S. West (1876–1919) in England for identification, and the most interesting of these were described in West (1905) and Hardy (1906). The latter publication included five descriptions supplied by West, two of which were macroalgae (a species of *Monostroma* Thuret and of *Oedogonium*).

In 1909, West published a monumental paper on the

algae from Yan Yean Reservoir: Tyler & Wickham (1988) give a delightful, if romantic, perspective on the microalgae of this focal point for freshwater phycology in Australia. Hardy collected all the algae for this opus. In it, a number of macroalgae from the weedy margin of Yan Yean Reservoir (two species and forms of *Oedogonium*, and one species each of *Ulothrix* Kützing, *Radiofilum* Schmidle, *Mougeotia* C. Agardh, *Debarya* Wittrock and *Zygnema* C. Agardh) were described and illustrated. Five of the macroalgal taxa were new to science including one, *Debarya hardyi* West (1909) named in honour of the collector. Additional macroalgae from nearby creeks and reservoirs were also listed by West. George West has a secure place as a luminary in the history of freshwater algal studies in Victoria, but since his main involvement was with the microalgae and phytoplankton, he is not considered any further here.

Hardy, meanwhile, had included these records and others, mostly from around Melbourne, in his lists of freshwater algae from Victoria (Hardy 1904b, 1905, 1906) and also published on a filamentous alga growing on fish (Hardy 1907, 1910, including a list of algae from the Yarra River, at Kew) and other interesting freshwater algal topics (Hardy 1911, 1913, 1936, 1938a, 1938b, 1943). He gave lectures on freshwater algae (Hardy 1938c) and provided information on collections by himself and other naturalists on excursions (e.g. Hardy 1914, Shephard *et al.* 1918a). In addition, he produced numerous papers on other aspects of natural history (Barnes 1976). All records of algae by Hardy included authorities and approximate localities. Some were described — those that were either new or 'interesting' — and a few were also illustrated. For those algae not determined by West, Hardy based his identifications on published descriptions (Hardy 1905, 1906; West 1905). Some of the important literature was supplied by West and Borge (Hardy 1905).

Hardy also had some contact with the University of Melbourne School of Botany. From 1914, Ethel I. McLennan (1891–1983) joined Hardy on some of his collecting trips and helped with identifications. She also provided some access to additional literature. Hardy would later send her material 'when requested or when the material, in [his] opinion, [was] of sufficient interest' (Hardy 1931–1955, unpubl.). Iona G. MacLennan (now Christianson) accompanied Hardy on a couple of trips in the 1940s, and some of his final boating days, during 1947–1955, were spent with Sophie C. Ducker.

Hardy, who gave only tentative acceptance to the species determinations of Watts, sought to improve the standard of freshwater algal taxonomy in Victoria. He gave authorities and localities, and tried to obtain a wide range of taxonomic literature. In his own publications, however, we don't know why he identified most macroalgae as he did: no distinguishing features or precise taxonomic references are given. Of the macroalgae he recorded himself, only a couple were described (by West), and, although a draughtsman by trade, none were illustrated.

Few of Hardy's collections survive today. There are 99 small vials of formalin preserved material (some of which has dried out) held in West's collections at the British Museum of Natural History (BM), and a box of permanent slides is retained in Australia (M.M.B.W.). Most of the algae in these collections have been adequately described by West (Hardy 1906, West 1909). In MEL, there are only three permanent slides of desmids, and a permanent slide and three sheets of dried material of *Monostroma expansa* G. S. West (Hardy 1906; MEL 666239, MEL 666240, MEL 666241). The type material of *M. expansa* (Fig. 1b) is in excellent condition.

Apparently, Hardy felt that only newly described species needed to be well documented and preserved. Yet, few freshwater macroalgae seem to be endemic, and it is their spatial and temporal distribution that is of most scientific interest. So, as with Watts, the records of genera are probably reliable but few specific determinations of macroalgae can be confirmed. In addition, even though Hardy gave localities, some of these are rather vague: e.g. 'Yarra River' or 'Yarra River (backwater)' for a river system with a catchment of 1,200 km^2!

Of course, both Watts and Hardy were naturalists with many other interests in life. They collected freshwater algae out of a love of studying the more obscure parts of nature. And so, with no formal training they did an excellent job of collecting plants, naming them and exciting the interest of their colleagues. The problem, however, is that they provide almost the sole legacy of freshwater algal study in Victoria. From this point of view, they did not leave a particularly solid foundation for the future.

There was no rush to build on even these shaky foundations (Table I). Besides a report (De Toni & Forti 1922) on some algae found early in the century, and a study of soil algae by Phillipson (1935), there were no published records of new collections until after 1939. The next reports came from Cookson (1953), who studied Cainozoic deposits, and Ducker (1958), who found a new species of *Basicladia* Hoffman & Tilden on the back of turtles. A collection from last century, however, had been re-examined by the Latvian phycologist Heinrichs L. Skuja; the results were published in 1934, while Hardy was still in his phycological prime.

Heinrichs Leonhards Skuja (1892–1972)

Heinrichs Skuja was a distinguished European specialist on freshwater algae who worked in Riga, and later Uppsala (Thomasson 1974, includes photograph of Skuja). His descriptions and drawings of species were always meticulous, leaving no doubt as to the plants he saw. Skuja wanted to revise the freshwater Rhodophyta, and was sent collections from throughout the world (Willén 1979). He lost most of his early collections when he fled from Latvia to Sweden in a small open boat during the second world war (F. Ott, pers. comm. July 1981). At the time of his death, Skuja had completed little of this monograph.

Skuja gave many manuscript names to specimens, but only a few were formally described. Australian and New Zealand herbaria hold a number of Skuja's *nomina nuda*: Cassie (1984) lists 4 species and one variety of *Batrachospermum* from New Zealand which are Skuja *nomina nuda* or *nomina dubia*. Luckily, Skuja (1934) published his description and illustration of a specimen examined from MEL, now at Botanischer Gurten und Botanisches Museum Berlin-Dahlem (B),

as a new genus and species, *Nothocladus nodosus*. This was based on the material collected by Watts in 1884, from the Yarra River, Collingwood.

Skuja (1934) described a second species in that genus, *N. tasmanicus*, from a specimen collected in Cataract River, Launceston, Tasmania, and held at the Herbarium, Royal Botanic Gardens (K). The plants originally had been identified as *Batrachospermum vagum* Sirodot by Harvey (1860). Subsequently, *N. tasmanicus* has been placed in synonymy with *N. nodosus* (Entwisle & Kraft 1984). No other descriptions of Australian algae by Skuja were ever published, although he received a number of specimens from Tasmania in 1968–1970, collected by Dr Peter Tyler (Skuja 1968–1970, unpubl.), and from many Australian herbaria (e.g. MEL, HO, ADU).

With most freshwater algae, an accurate illustration and description are far more valuable than the type for understanding the plant on which a name is based. Observations on freshly collected material, or plants preserved in liquid, are usually essential. Yet, Skuja's description and illustration of *Nothocladus nodosus* were made from a 50-year-old dried specimen. Kützing (1882, unpubl.) described the same specimen as perhaps a new species of *Batrachospermum*, but in a state of deterioration. So we have Watts to thank for the voucher specimen, and Skuja, for his phytographic skills. Thankfully, the important taxonomic features remained intact in this dry preserved specimen.

Conclusions

There must be at least one feature of the floristic legacy that I proposed at the beginning of this paper, for a record to be of any scientific value. Watts has left mostly incompletely labelled voucher specimens, and his published records are inadequate. Hardy left a voucher specimen for only one of his macroalgae, and only rarely provided adequate published evidence for his determinations. West, however, immortalized some of his earlier records of macroalgae. Skuja didn't collect here, but provided a classic taxonomic account of one species from Victoria. The other *nomina nuda*, of course, detract from his record. Overall, one might have hoped for more.

The legacy of freshwater phycology in Victoria is certainly lean. The pickings of macroscopic algae are few: some historically interesting generic records and a handful of taxa well described and illustrated. The bulk of the state is still to be explored for freshwater algae.

Effectively, all studies on freshwater macroalgae from Victoria start with an almost clean slate. This is both exciting and saddening. In the last 10 years there has been renewed interest in the freshwater algae of Victoria (Foged 1978; Chessman 1982, 1985a, 1985b, 1986a, 1986b; Entwisle & Kraft 1984; Christensen 1986, 1987; Entwisle 1987, 1988a, 1988b, 1989; Tyler & Wickham 1988). One can only hope that the scientific legacy currently accruing is better appreciated in 50 years time.

Finally, there is a legacy that should not be overlooked. Hardy's neighbours and friends will long remember him entertaining and teaching them microscopy on his front porch in Kew, where, for many, the discovery of freshwater algae really began.

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Type specimens of bryophytes in Australian herbaria

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Abstract

A brief history of bryophyte taxonomy in Australia and the status of bryophyte collections in Australian herbaria is given. Most Australian species described prior to the 1960s were named by researchers in Europe and the type specimens retained there. Thus only isotypes were retained in Australia. Holotypes were rarely designated by bryologists and often many syntypes are listed in the protologue. Among collections are many putative type specimens. As these are of particular importance to monographers and location of types is often difficult and time consuming, we have traced specimens designated as types or *nov. sp.* in Australian herbaria, located literature, and designated the status of the type, after communication with overseas herbaria where the author of the type description worked. Label data for each specimen is being stored in a database file (dBase III) for continued access and analysis. The most recent information on the status of the basionym is included together with suggested action if lectotypification is required. The results will appear in a series of separate publications.

In this Bicentennial year when we are surveying our history and heritage, it is appropriate to consider how much or how little we know about our flora, not only vascular plants, including flowering plants and ferns, but those less obvious but equally important cryptogams, the bryophytes, lichens and algae. Only bryophytes are discussed here.

History of Bryological studies in Australia

Very few collections of bryophytes (mosses, liverworts and hornworts) were made in Australia in the early to mid-1800s but those of botanists such as J. D. Hooker (Tasmania and Antarctica), J. Drummond & L. Preiss (Western Australia) are important (Scott & Stone 1976, Catcheside 1980).

In the second half of the nineteenth century, however, resident botanists working on local floras added a considerable number of specimens to Australian herbaria (Willis 1949). These botanists included Ferdinand Mueller (Victoria and eastern Australia); Sullivan, Bastow (Victoria); Bastow, Weymouth, Rodway (Tasmania); Forsyth, Whitelegge, Watts (New South Wales); Bailey, Watts, Wild (Queensland). By exchange, correspondence, and publication of new species they highlighted to the rest of the world the uniqueness of our bryoflora (refer to bibliography in Scott & Stone 1976).

The research and description of these was carried out largely by European botanists (e.g. C. Müller 1897, 1898, 1901). The first attempt to produce a complete list of Australian mosses was undertaken by Edward Hampe (1880) at 85 years of age. He systematically arranged the names known to him from mainland Australia. The list was mainly based on his own collections and those of the British bryologist, William Mitten. Ferdinand Mueller (1882) completed this list, adding species from Western Australia and Tasmania, and incorporating information provided by Mitten while Forsyth (1900) increased the known species from New South Wales by 43. Preliminary studies on hepatics were published by Stephani and Watts (1914). Mitten (1856) published a list of F. Mueller's collections of both mosses and hepatics in Victoria and it is one of the earliest lists. All this information was drawn together in monumental works on Musci by Brotherus (vol 10 & 11) and Hepaticae by Schiffner (vol 9) in Engler & Prantl's, *Die naturlichen Pflanzenfamilien* (1924–5) where names of species and their geographical location are given (in German) with some keys and clues to important characters. To extract from this is both tedious and unsatisfactory as a number of names may occur grouped together with the same set of key characters without any means of differentiating between them. Thus the only method for true identification has been to obtain the type description from literature, then check the type specimen of all those species considered closely related.

The next attempt to catalogue the mosses of Australia was that of Watts & Whitelegge (1902, 1905) who produced part of a Census of Australian mosses, later completed by Burges (1932, 1935). Only scattered publications relating to Australian species appeared between 1915 and 1960, primarily those of Burges (1932, 1935) and Willis, between 1952 and 1958, who presented a centennial review of studies in Victoria in 1955. Until the publication of Scott & Stone's (1976) *Mosses of southern Australia* we had to rely on Rodway's (1914, 1916) *Tasmanian bryophyta*, early scattered papers of C. Müller, Brotherus & Watts, Willis, Forsyth and overseas researchers on Australian mosses, and to Sainsbury's (1955) *Handbook of New Zealand mosses*. *The mosses of South Australia* (Catcheside 1980) added valuable information on some arid zone species. All these dealt almost exclu-

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EPHEMERELLA readeri C. Muell. Vic.

Loc.: Basin of old Sheep Wash,
Upper Region Station Vic.

Coll.: F. M. Reader 3. IX. 1894
Watts Vic 8

≡ Physcomitrium readeri (C. Muell.) Roth.

C. Müller: Symbolae ad Bryologiam Australiae III
Hedwigia 41: 120 (1902)

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303. Ephemerella (Physcomitridium) Readeri n. sp.; dioica, robusta caulescens sed perbrevis simplex late gregarie cespitosa viridissima; inferne tenuis nuda apicem versus foliis nonnullis paucis magnis erectis imbricatis mollibus obtecta; folia e basi brevissima angustiore in laminam late cochleariformi-ovatam acumine brevissimo obtusiusculo terminatam producta, margine erecto superne cellulis protuberantibus breviter obtusato-serrata, nervo obsoleto laxissime reticulato mediano lenissime exarata, e cellulis magnis laxis amplis mollibus reticulata; theca in pedicello perbrevi crassiusculo molli flavido immersa majuscula globosa oblique rostellata virescens mollis, calyptra distincte dimidiata stylifera operculum solum obtegente pallidissima tenuiter membranacea; sporae permultae magnae aureae.

Habitatio. Australia, Victoria, Dimboola, solo humido, Septembri 1897: Fr. Reader, qui 1898 ex Dimboola communicavit.

Species maxime memorabilis, inter Ephemerellas locum tenens, ut Ephemerum patens inter Ephemera, habitu physcomitriaceo.

Fig. 1. Card index format. Front of card above, back of card below.

TAXON: Basionym.
REF: Reference for basionym.
LABEL: Specimen label data. When there are several specimens each individual variation is entered. Latitude and longitude may be given here as additional information.
PROTO: Protologue - geographical location of type collection.
AUSTR: Australian herbarium, status of type and actual collectors numbers held in each.
NON: Other herbaria holding type specimens, status of type and collectors numbers held there where known.
REC: Remarks including present name if different, reference to recent treatment, action required e.g. need to choose lectotype etc.

Fig. 2. Format for entry of data into dBase III.

sively with temperate taxa and virtually nothing was or is yet available on tropical and subtropical species. Scott (1982) pointed out that Australia consisted of two phytogeographical regions, temperate and tropical, and emphasized the need for extensive studies in the tropical regions. In particular he stressed the paucity of information on hepatics as no flora, even for a single region, had been produced up to that time. This has been redressed since then, largely for the temperate areas, by Scott with two publications — a checklist of Australian liverworts (Scott & Bradshaw 1986) and *Southern Australian liverworts* (Scott 1985).

There is still no overall flora available for subtropical and tropical species but publications, scattered in recent literature, by Stone (e.g. 1976, 1977, 1983a & b, 1984, 1985) and Stone and others between 1961 and

1988 (many papers) have added many new and important taxa. In Australia as a whole the activity of researchers such as Seppelt (1982a & b) Lewinsky (1984), Vitt & Ramsay (1985), Catcheside (1987), Reese & Stone (1987), Frahm (1987) and others on mosses and by Hewson (1970a & b), Na-Thalang (1980), Scott (1985, 1987), Scott & Pike (1984, 1987a & b), Theirs (1987), Windolf (1987), Hattori (1979a & b, 1984, 1987), Ratkowsky (1987) on liverworts, to mention a few summary papers, are increasing our knowledge. More complete reference lists for recent publications can be found in Ramsay (1984) and Ramsay & Selkirk (1985–1988). It is true to say that from studies that have been undertaken to date that the moss and hepatic flora in Australia is extensive and new taxa are being discovered at all levels with careful and continuous collecting.

Since 1982 there has been an even greater explosion of knowledge, as the collections and publications of those mentioned above and others indicate. The publication by Streimann & Curnow (in press) cataloguing all Australian mosses in literature, together with a complete bibliography, will soon give us a true estimate of our present knowledge and become a most valuable guide for future investigations.

Bryophyte collections in Australian herbaria

The major herbaria in Australia all have some bryophyte collections which, until the last ten years, had received little taxonomic attention. They have usually been poorly curated, except for those in National Herbarium of Victoria (MEL) where J. H. Willis was working. For example, specimens at the National Herbarium of New South Wales, such as those of W. W. Watts, were in old folded packets made from church newspapers, their original paper wrapping, and largely unsorted. Collections in all Australian herbaria are now packaged and sorted although there are substantial numbers not yet identified. Few herbaria have a trained bryologist on the staff. Overseas monographers such as Vitt, Lewinsky, Reese and Touw have contributed in recent years by correctly naming collections from many Australian herbaria. The numbers of specimens available for study has been increased also by Australian workers investigating bryologically rich but previously uncollected geographical and ecological areas such as north Queensland rainforest, the Northern Territory, arid regions of South and central Australia, south-western Western Australia and the Kimberleys. Additional and important new specimens have been added from other areas. There has been valuable research input also from overseas visitors and those who have studied here.

The present estimate of the size of the bryophyte collections available for study in Australia is given in Table I, the data having been extracted and updated from Vitt *et al.* (1985). In addition there are some substantial private collections for which no data are available.

Collections at NSW

The bryophyte collection at NSW, with which we are most familiar, was until recently the largest held in any Australian herbarium (Table I). The bulk of it, containing large collections by Forsyth, Whitelegge and Watts, was accumulated in the late 1800s and early this century, making it of historical importance. It is this collection to which we refer in detail. The number of type collections, formerly estimated as at least 200 (Ramsay & Briggs 1979), has been found to be much larger (Table I), and contains types of Australian mosses and liverworts, a large number of types of exotic mosses sent on exchange to W. W. Watts early this century (Ramsay 1980) and some important types of liverworts collected in the 1960s by Hewson and Na Thalang. In fact, the bulk of bryophyte types held in Australia are housed here.

Table I
Estimated size of bryophyte collections in Australian herbaria*

Herb.	Mosses	Types	Liverworts	Types
AD	4,000	?	1,000	?
BRI	6,113	90	1,026	15
CANB	5,900	54	1,500	8
CBG	40,284	12	14,400	12
HO	13,000	20	6,000	160
MEL	30,000	c. 200	3,700	?
MELU	16,000	c. 20	300	?
MUCV	2,500	—	2,500	10
PERTH	2,000	10	?	?
NSW	39,300	775**	6,000	90
SYD	1,800	1	2,284	—
UNSW	8,000	—	200	—
UWA	1,500	?	?	?
Total	170,397	1,164	38,910	295

Published names for Australian mosses c. 4,000
Presently accepted names c. 1,300
* from data available at 17 Dec. 1988
** Exotic species 460, Australian species 315
? = no information obtained
— = no types present

Type specimens of bryophytes

Correct names for bryophytes are dependent on correctly published type descriptions in the same way as they are for vascular plants. The type specimen thus represents the historical basis for the taxonomic name and is vital for any reassessment of the taxon with time. For moss taxa the starting point for the valid publication of names is 1801 (Hedwig's *Species Muscorum*) and for hepatics it is 1753 (Linnaeus's *Species Plantarum*). The publication of *Index Muscorum* (Wijk *et al.* 1959–1969) and supplements (Crosby 1977, 1978; Crosby & Bauer 1981, 1983, 1987; Bauer & Crosby 1985) and *Index Hepaticarum* (Bonner 1962–1978) and supplements (Engel 1984) provide a ready source of published names and synonyms.

In the absence of specialist bryologists in Australia until the mid 1900s specimens were sent to Europe for naming by W. Mitten, C. Müller, V. F. Brotherus, F. Stephani and H. N. Dixon. This meant that in the past, type specimens were retained by the authors of the names and description and are still located overseas. Some duplicates, isotypes and syntypes, were retained in Australia. Holotypes of more recently described taxa are now retained in Australia.

Preparation of register of type specimens

The necessity for referral to type specimens for monographic revisions is well understood and locating such specimens can be time consuming. A specimen-based approach or the production of a type register locates putative types in herbaria. This is followed by a literature search to confirm the status of each specimen.

Bryum aequicollum Broth. & Watts
Proc. Linn. Soc. New South Wales 40: 372 (1915)

Label
1. Second open gully, S. of King's, LHI, W. W. Watts 213a, 15.vii.1911.
2. Mt Gower, LHI, W. W. Watts 360, 1-4.viii.1911.
3. Open gully just S of King's, LHI, W. W. Watts 147d.
4. Rocks S. of King's, LHI, W. W. Watts 207, 15.vii.1911.
5. Mt. Gower, LHI, W. W. Watts 408, 1-4.viii.1911.

Proto
"Among rocks one mile south of King's (n 207); open gully south of King's (n 147d, 213a); Mt Gower (n 360, 408); also Northern Hills and sea cliff, Middle Beach."

ISOSYN: NSW (Watts 147d, 207, 213a, 360, 408)
SYN: H-BR. (Watts 147d, 207, 213a, 360, 408)

Rec
[= *B. dichotomum* Hedw., based on specimens cited by Ochi (1970: 17): Watts 147d, 213a, 360 from H. Not lectotypified by Ochi.]

* * *

Macromitrium subbrevicaule Broth. & Watts
Proc. Linn. Soc. New South Wales 40: 371 (1915)

Label
1. North Head, LHI, W. W. Watts 478 viii.1911
2. North Head, LHI, W. W. Watts 507 viii.1911
3. Northern Hills, LHI, W. W. Watts 239 21.vii.1911
4. North Head, LHI, W. W. Watts 504 viii.1911
5. Top of Northern Hills, LHI, W. W. Watts 236 21.vii.1911
6. Seacliff, top of Northern Hills, LHI, W. W. Watts 21.vii.1911

Proto
'Growing mostly on cliffs at North Head and on the Northern Hills (n 236, 239, 478, 504, 507).'

ISOLECTO: NSW (Watts 239); SYN: NSW (Watts 236, 478, 504, 507)
LECTO: H-BR. (Watts 239) Vitt & Ramsay, 1985; SYN: H-BR.

Rec
[= *M. brevicaule* (Besch.) Broth. Vitt & Ramsay, (1985: 381-382) Specimen 6 above without collection number is annotated probably an Isotype, data match protologue D. H. Vitt Nov. 6 1984]

Fig. 3. Examples of computer printout.

Early bryologists rarely designated holotypes, often naming a series of specimens in the protologue (syntypes). This necessitates choosing a lectotype when carrying out a revision, a procedure which must be done carefully to avoid future nomenclatural problems.

In this project we have traced type specimens of Australian mosses in all Australian herbaria, located relevant literature and are in the process of storing the data in a database program (dBase III) for continued access and analysis. The aim is to compile a register of type specimens held in Australian herbaria.

All label data have been collected from putative type specimens onto index cards (Fig. 1). The data are then extracted and assembled into dBase III using the format as set out in Fig. 2. Label data are then compared with the protologue to confirm it is a type. We have included the abbreviation for each herbarium holding types in Australia and sought information from the overseas herbarium likely to have the original specimen on which the protologue was based. The resultant data printout is given as Fig. 3.

This kind of register (Ramsay *et al.*, in press), whilst extremely time consuming to produce, has been of great value in helping to find and define type specimens available for study in Australia. At NSW the type collection has been extracted from the main collection for assessment. All specimens with 'type' written on them and all with *nov. sp.* have been set aside for checking. The literature search has quickly indicated those which are *nomina nuda*. From the protologue it has been possible to find types, additional to those ori-

ginally detected, by checking in the main collection for the collector's numbers given in the protologue. The card index system provides a permanent record of the specimen data and the literature.

The advantages of this kind of register can be summarized as follows:

1. rapid accessibility to location of type specimens;
2. up to date information on recent revisions;
3. data management for many forms of request, including print outs of all taxa in a particular genus or herbarium;
4. continuing capacity to update as new species are described or new synonymics made;
5. time saving facility enabling data search without need to handle fragile specimens.

Results of the studies will appear as a series of multi-authored publications including Australian mosses, special collections at NSW, exotic species, hepatic types at NSW and Carl Müller specimens at NSW.

Acknowledgements

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Aspects of Australian mycology: 1800–1900

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Abstract

The history of Australian mycology is generally poorly documented. Robert Brown initially recorded a few species of fungi from collections gathered during Flinders's voyage, 1801–1805. During the subsequent 70 years less than 20 papers were published on Australian fungi; by M. J. Berkeley on the collections of Cunningham, Gunn and Drummond and by E. M. Fries on the collections of Preiss. From 1873 to 1900, about 140 publications were contributed to the taxonomy of Australian fungi. Prominent authors included M. J. Berkeley, M. C. Cooke and C. Kalchbrenner. The focus of many of these publications can be often related to the collecting activities of botanists such as F. J. H. Mueller and F. M. Bailey. By 1892 approximately 2,000 fungal species were listed in Cooke's *Handbook of Australian fungi*.

By 1900 the most significant contributions by a resident mycologist were by D. McAlpine, the Victorian Government Vegetable Pathologist. His *Systematic arrangement of Australian fungi* (1895) included the first host index of Australian fungi.

Some of the important problems associated with the collection, naming and storage of Australian fungal taxa during the 19th century are illustrated by consideration of Australian Meliolaceae (black mildews).

Labillardière and the first description of an Australian fungus

The origins of Australian mycology can be traced to the D'Entrecasteaux expedition which sailed from France in 1791 in search of La Perouse. During this voyage the ships visited south-west Australia and Tasmania and extensive plant collections were made by the naturalist Jacques Labillardière. The fate of personnel and collections associated with this eventful expedition have been discussed by Carr and Carr (1981). An account of the voyage was published by Labillardière (1800). Two translations into English were made in the same year; a second edition was produced in 1802. On 1 May 1792, Labillardière was on the shore of Recherche Bay in southern Tasmania. He (Labillardière 1802, p. 156) recorded:

> I was agreeably surprised with the singular form of a new genus of mushroom, which grew from the middle of the mosses with which the ground was covered. The disposition of its rays made me name it *aseroe*.
>
> Its root consists of small filaments attached to a fungous tubercle, on which rests a volva, globular, whitish, and gelatinous, marked with seven *striae* without and within.
>
> From the middle of this volva issues a reddish peduncle (*stipes*), nearly cylindrical, hollow throughout its whole length and open at its upper extremity, which, is expanded, of a beautiful red colour, and divided into six bifurcated rays, yellowish at their extremity.
>
> This mushroom is smooth in every part. This new genus ought to be classed next to the *phallus* genus of Linnaeus.

The fungus was called *Aseroe rubra* on Plate XII. Labillardière later published descriptions of 265 species of plants in his *Novae Hollandiae plantarum specimen* (1804–1807). The eppendix, first published in 1807, included a Latin diagnosis of *Aseroë rubra*, the starfish fungus. This was the first fungus to be described from Australia.

Brown and Bauer

HMS *Investigator*, under the command of Captain Matthew Flinders sailed from England in July 1801. The accompanying scientific team included Robert Brown (botanist) and Ferdinand Bauer ('natural history painter'). During the next four years many botanical collections were obtained from various locations around the coast of Australia, including Tasmania and Norfolk Island. Brown and Bauer returned to England in 1805 with sketches and plant collections. Many plant specimens had been previously lost when Flinders attempted to return to England in the HMS *Porpoise* which unfortunately struck Wreck [Cato] Reef. Brown was directed by the Admiralty to describe new species from Australia as well as those plants collected in other Australian expeditions. Much of this work was completed by 1810 when his celebrated *Prodromus florae Novae Hollandiae* was published. The initial part of this work was planned to include the Acotyledons or cryptogams. Lack of interest in the publication caused Brown to withdraw it from sale and consequently no fungal descriptions ever appeared. However, he (Brown 1814) later contributed an appendix to Flinders's *A voyage to Terra australis* and listed ten fungal species, 'natives of both Terra Australis and of Europe'. These were *Agaricus alneus* L., *A. campestris* L., *A. muscarius* L., *Boletus igniarius* L., *Clavaria pistillaris* L., *C. coralloides* L., *Peziza scutellata* L. *Rhizomorpha setiformis* Pers., *Sphaeria ophioglossoides* Pers., and *Tubercularia vulgaris* Pers. Although no locations were given, this list indicated that Australian fungi were probably more cosmopolitan than the

flowering plants. The small number of fungi contrasted with a complementary list of 58 lichens in the same appendix. Brown also remarked that, 'with regard to the proportion of Acotyledons in Terra Australis, it is necessary to premise that I consider my collections of some of the Cryptogamous orders, especially the Fungi, as very imperfect' (Brown 1814, p. 538).

Ferdinand Bauer sketched more than 1,700 Australian plants. On his return to England he was commissioned by the Admiralty to complete paintings of plants to be selected by Robert Brown and Joseph Banks. Of a group of 236 Bauer paintings in the British Museum (Natural History), Nos. 230–236 are of nine species of fungi. However, none of the names correspond with Brown's list and no locations are given. One of the works is an illustration of *Aseroë rubra* Labill.

Gaudichaud and Persoon

Charles Gaudichaud-Beauprè was the botanist on the Freycinet expedition to the west coast of Australia and New South Wales in 1818–1819. Extensive plant collections were made in these areas although relatively few species were described by Gaudichaud (1826–1830) in Freycinet's *Voyage autour du monde ... exècutè sur les corvettes de S.M. l'Uranie et la Physicienne.* The few fungi and lichens collected during this voyage were determined by C. H. Persoon. Only one species, *Cladoderris dendritica* Pers., was later listed in English mycological literature. Between 1800 and 1838 at least six other French expeditions came to some part of Australia and were involved in botanical collections. No information has been found concerning either collection or identification of fungi.

Berkeley and his collectors

Between 1817 and 1831, Allan Cunningham (the 'King's Botanist') travelled extensively throughout Australia and amassed large plant collections. The specimens were mostly sent to Kew and included fungi, some of which were described by the Rev. M. J. Berkeley in 1839. Our knowledge of Cunningham's interest in fungi is fragmentary although comments are made in his journals: 'A curious species of Fungi, *Agaricus*, of a yellowish colour, which upon being broken and exposed to air immediately assumed a blue tint' (6 May 1817; Lee 1925, p. 204.)

It could also be presumed that some of the fungi Berkeley described as being found in 'Illawarra' are Cunningham collections, because of his collecting excursions to the area. Whether the contemporary Colonial Botanist, Charles Fraser, also collected and forwarded specimens of fungi to England is unknown.

Robert Lawrence became W. J. Hooker's botanical correspondent in Tasmania in 1830. He died only three years later but, in the interim, had introduced R. C. Gunn, his friend and co-collector, to Hooker. Gunn continued the scientific association with Hooker in Glasgow. By 1840 he was private secretary to Governor Franklin and secretary of the Tasmanian Natural History Society. During the period from 1832 to 1850, Gunn 'collected indefatigably over a great part of Tasmania . . . and collected large suites of specimens with singular tact and judgment. They have all been transmitted to England in perfect preservation and are accompanied with notes that display remarkable powers of observation' (Hooker 1859 p. cxxv). Fungal specimens collected by Lawrence and Gunn were forwarded to Berkeley in England. He described some of these in *Annals of Natural History* (Berkeley 1839). This represents the first English taxonomic treatment of Australian fungi — 50 years after settlement began! Berkeley (1845) continued to describe Tasmanian fungi in the *London Journal of Botany* and named two of the more unusual species in honour of Gunn: *Cordyceps gunnii* Berk. ('vegetable caterpillar') and *Cyttaria gunnii* Berk. [parasitic on *Nothofagus cunninghamii* (Hook.) Oersted.]. On separate occasions, in 1840 and 1841, J. D. Hooker spent time with Gunn in Tasmania while attached to the Antarctic Expedition of Capt. Ross in the HMS *Erebus* and HMS *Terror*. Again, many fungi were collected and given to Berkeley. These fungi, plus collections made by William Archer between 1847 and 1857, form the basis of Berkeley's (1859) contribution to Hooker's *Flora Tasmaniae*. In his introductory statement Berkeley (1859, p. 241) wrote:

> The great characteristic of Tasmanian Fungi, of which 275 species are here enumerated, is their identity with or close relation to European forms. A very few only partake of a subtropical nature while no considerable number of species exhibit any striking peculiarity . . . The three genera which abound most in species are *Agaricus*, *Polyporus* and *Peziza*. About eight species only can be considered as peculiarly Australian.

Berkeley described 99 new species of fungi from Tasmania in Hooker's *Flora Tasmaniae*. However, Archer deserves special mention as he contributed specimens of 211 species (77% of the total). Berkeley reflected this effort by giving the epithet 'archeri' to at least 15 of the species.

During the period Gunn and his associates were collecting fungi in Tasmania, James Drummond (ex-curator of the Botanic Gardens in Cork, Ireland) had emigrated to the Swan River Colony in 1829. It is rather coincidental that he travelled in the *Parmelia*, a name also applied to a large group of lichenised fungi, specimens of which he later collected. Drummond's plant collections remain as some of the most extensive from Western Australia and also contained some fungi. In a letter to W. J. Hooker in 1843 mention was made of the collection of 300 species of fungi (Erickson 1969, p. 74). About 130 fungal specimens were forwarded via Hooker to Berkeley, who described and published some of them in Hooker's *Journal of Botany* (1845). Drummond (1841) also wrote to Hooker on the luminescence of fungi, a topic which also attracted casual attention from other botanists for many years; he also recorded the use of geocarpic fungi as food by small marsupials (Erickson 1969).

Fries and Preiss

From 1838 to 1842, Ludwig Preiss engaged in natural history collections in southwest Australia. His systematic approach to collecting specimens was reflected in a public offer to sell shares for potential collections (Ducker 1981). In addition to a wealth of plant specimens a largely unknown number of fungi were obtained. It is also known that Preiss accompanied Drummond on some excursions although their contrasting personalities often led to friction. When Preiss

returned to Europe in 1842 the remaining collections were sold and/or dispersed to specialists for taxonomic studies. The fungi and lichens were observed and described by Elias M. Fries, 'the Linnaeus of mycology' (Hawksworth *et al.* 1983, p. 151) and he (Fries 1847) published an account of 40 species of fungi in J. G. C. Lehmann's *Plantae Preissianae* (1844–1848). The apparent disregard this work received from plant taxonomists in Britain also applied to mycologists as it took 40 years for the species to be included in English scientific journals (e.g. Cooke 1882).

Mueller, Kalchbrenner and other resident botanists and collectors

In 1847 Dr Ferdinand Mueller emigrated to South Australia. He was subsequently appointed Government Botanist of Victoria in 1853. In almost 50 years in this country Mueller made a botanical contribution of unequalled magnitude and value. Early in his career he travelled extensively throughout Australia and amassed a large herbarium. During this period, and later, Mueller organized a large number of amateur (and paid!) collectors to forward specimens to Melbourne. Most of his attention was given to the taxonomy of flowering plants while 'having wisely forwarded all the Musci and following Orders of Cryptogams to European specialists' (Bailey 1891). The extent of Mueller's own fungal collections is unknown but it was probably of some significance.

Although perusal of literature concerning Australian fungi gives an impression of mycological inactivity in a 25 year period (from 1848 to 1873) Mueller and others apparently continued to supply European mycologists with specimens. Berkeley (1873) initiated publication of these specimens and was followed by Thümen (1875, 1878), Kalchbrenner (1876) and Berkeley and Broome (1880, 1882, 1886). Taxonomy of the Australian mycoflora was receiving increasing attention in a variety of European scientific journals. Berkeley (1877) also enumerated some Australian fungi collected by H. N. Moseley during the expedition of HMS *Challenger*. The location 'Pennant Hills, Parramatta' suggests that Moseley was assisted by that enthusiastic botanist, Rev. W. Woolls. Mordecai C. Cooke began his extensive series of papers on Australian fungi in *Grevillea* in 1880 and continued the series until 1894. Mueller compiled 11 volumes of his *Fragmenta phytographiae Australiae* between 1858 and 1881 and commissioned Cooke (1883) to produce a supplement called *Fungi australiani*. It was 'an enumeration of the species hitherto recorded as occurring in Australia, Tasmania, Lord Howe's Island, etc. exclusive of New Zealand) with figures of some species described by the Rev. C. Kalchbrenner.' About 1,200 species were listed including 45 new names and descriptions (see Table I). It was the first attempt to compile a fungus 'flora' of Australia from various British and European sources. Apparently *Fungi australiani* did not become widely known as 'the bulk of the copies were lost at sea' (Cooke 1892). The publication gave some indication of the distribution of fungal taxa in Australia (by states or territories) and of their collectors. Some of the more frequently mentioned collectors were:

Queensland: W. E. Armit, F. M. Bailey, T. L. & J. Bancroft, L. A. Bernays, E. M. Bowman, J. Dallachy, C. H. Hartmann, J. Keys, T. Pentske, W. Persieh, B. Scortechini, J. E. Tenison-Woods, M. A. Thozet, H. Tryon.

New South Wales: Miss Bate, H. Beckler, A. Camara, M. Hodgkinson, R. Thornton, T. F. Willcox, W. Woolls, W. Guilfoyle, C. Stuart.

Victoria: F. M. Campbell, C. French, F. Reader, H. T. Tisdall.

South Australia: R. M. Schomburgk, J. G. O. Tepper.

Mueller also named and described some Australian fungi — probably more than the four species given by Muir (1979). Mueller (1885) published notes on the botany of Norfolk Island (based on specimens collected by Mr Isaac Robinson). A list of nine fungi was included, to which J. H. Maiden (1903) added another four species.

Hoare (1981) has documented the efforts of botanists and others who 'cultivated science' to form scientific societies in the eastern states. By 1874 all states, with the exception of Queensland, had an active 'Royal Society' and the Linnean Society had begun to publish in New South Wales. The first paper in a journal of these societies to extensively discuss Australian fungi was written by J. E. Tenison-Woods and F. M. Bailey in 1880. In a comment on Australian botany the authors stated that fungi 'have never been approached in a systematic manner by any author . . . We purpose to furnish a contribution to Australian mycology and so far as possible to popularize the subject with a view to stimulate enquiry' (Tenison-Wood & Bailey 1880, p. 50). It should be noted that this paper and subsequent contributions by Bailey in his *Synopsis of the Queensland flora* (1883–1890) largely reiterated lists and descriptions of fungi given in British journals. There were still no taxonomic mycologists in Australia and this situation contrasted with growing local activity in studies of Australian lichens (Wilson 1887; Shirley 1889). In 1883, Kalchbrenner (1883a-c) contributed three papers to the *Proc. Linn. Soc. New South Wales* in which 18 new species of basidiomycetes were described. They constitute the first taxonomic treatments of fungi in an Australian journal. Mueller, in an introductory note to one of the papers, commented in his inimitable style that, 'Though now at a far advanced evening of life and no longer enjoying unimpaired eyesight, the Hungarian Divine has elaborated some more Australian fungaceous plants . . .'(Mueller in Kalchbrenner 1883c, p. 638). It seems that Mueller was unable to cajole other European mycologists to publish in Australia.

Another group of enthusiasts who actively attempted to arouse some scientific interest in fungi were members of the Field Naturalists Club of Victoria. Miss F. M. Campbell and H. T. Tisdall frequently displayed fungi at meetings and wrote articles on their distribution, edibility, general biology and vegetable pathology (Campbell 1887; Tisdall 1884, 1889a,b, 1890). Both these members, as well as others, were encouraged to give specimens to Mueller. In turn he 'promised to forward to an eminent botanist in Switzerland who has made the order Phalloidei, his special subject' (presumably Ed. Fischer) or would 'kindly forward the fungs (sic) to Professor Cooke for

classification' (Tisdall 1889a, p. 110). Perhaps some of the impetus for general studies of fungi in the 1880s can be traced to the early writings of F. M. Bailey (1878). He provided glowing descriptions of the beauty of fungi in tropical forests and prophesied that fungi 'will some day yield a rich harvest to the Mycologist' (Bailey 1878, p. 279).

Fungi and agriculture

Virtually all food and fibre crops grown in Australia, as well as many pasture and fodder plants, have been introduced from other regions. It is not surprising that many fungal pathogens were introduced on seed and clonal material, or that indigenous fungi were provided with a new range of hosts. In fact, fungal diseases of crop plants have been one of the major limiting factors in Australian agriculture. A comprehensive review of the historical impact of cereal rusts was compiled by Waterhouse (1936). It is pertinent to recall that a dispatch from Governor Hunter (1796) probably gave the earliest reference to 'blight' in wheat crops.

'Rust' and 'smut' appeared as early as 1803 (King 1804) and mildews (Dawson 1830) some time later. There is little doubt that the first century of cereal growing in Australia was constantly plagued by fungal diseases. However, Cooke (1883b) was able to list only six rusts of crop plants and a few smuts from Australia. This situation reflected a lack of interest (or ignorance) of microfungi and especially plant pathogens. A few years earlier, Tenison-Woods and Bailey (1880, p. 56) had attempted:

> to call attention to the very great importance which the study of fungi possesses for a young country like ours, which depends so much upon its agriculture. Sad experience has taught us how its prospects may be injured by blight, mildews, smuts, rusts, etc. Little or nothing is known about the origin and spread of these terrible pests, and it is equally certain that if they were known they would in measure be provided against. Although by many mycologists the polymorphy of these blights has been doubted, yet experience seems to have decided that a blight of one kind affecting one class of plants may be transformed into a mildew or rust amongst cereal crops.

By the late 1880s rust epidemics in wheat crops had caused such concern that 'Rust in Wheat Conferences' were convened with delegates from each state. In the context of increasing awareness of the causes of plant disease, the New South Wales and Victorian governments decided to employ 'vegetable pathologists' in 1890. One of the appointees, Daniel McAlpine in Melbourne, was to become the founder of fungal systematics in Australia. Scientific co-operation was also gathering momentum as evidenced by the formation of the Australasian Association for the Advancement of Science. At the fourth meeting in Hobart F. M. Bailey contributed a comprehensive paper on 'fungus blights ... [on] living vegetation in the colony of Queensland' (Bailey 1893).

Edible fungi

During the first century of European settlement in Australia it is difficult to ascertain the degree to which people utilized fungi in their diet. It would be unusual if attempts were not made to utilise various 'mushrooms' similar to those consumed in Europe. The outcomes of early mycophagous experiences are largely unknown although most rural communities have certain guide-lines (or folklore) for selecting fungi. In general, Australians are very conservative in their consumption of fungi. Some reports of the uses of fungi by aborigines were recorded by early settlers. Meyer (1843) noted that puff-balls (*Lycoperdon* Pers. spp.) were eaten in South Australia. Another puff-ball [*Pisolithus tinctorius* Mich. ex Pers.) Coker & Couch] and the desert truffle [*Elderia arenivaga* (Cooke) McLennan] were eaten in Central Australia and also supplied 'potable water'. However, various taboos in certain tribes prohibited the eating of gilled fungi (Latz 1982). Probably the most frequent early reference to aboriginal use of fungi concerns *Polyporus mylittae* Cooke & Massee (native or 'blackfellows' bread). The large subterranean sclerotium (up to 20 kg) was dug up and eaten by various tribes throughout southern Australia. Berkeley (1839) gave a detailed description of the sclerotium (as *Mylitta australis* Berk.) and noted that 'this is the species of *Tuber* mentioned by Mr Backhouse in his account of the esculent plants of Van Diemans Land' (p. 325). Hooker (1859) included this fungus as well as *Agaricus campestris* L. ex Fr. (common mushroom) and *Cyttaria gunnii* Berk. in a list of the 'esculent plants of Australia'.

Cooke's *Handbook of Australian fungi* and taxonomy today

By 1892, M. C. Cooke had collated virtually all publications on Australian fungi and compiled his *Handbook of Australian fungi* (see Table I). In the preface he (Cooke 1892) wrote:

> It is not supposed that the present work is by any means exhaustive . . . since those [fungi] which are so minute as to require the aid of a pocket lens are far below the number which would be reasonably expected to occur over

Table I
Comparison of numbers of species listed in 'families' and 'orders' in Cooke's *Fungi australiani* (1883) and *Handbook of Australian fungi* (1892)

Fungal Groups		1883	1892	% increase
Hymenomycetes —	Agaracini	366	542	
	Polyporei	247	375	
	Hydnei	32	46	
	Thelephorei	87	130	
	Clavariei	29	49	
	Tremellini	23	32	
	Total	784	1,174	49.7
Gasteromycetes —	Phalloideae	27	28	
	Nidulariaceae	12	15	
	Lycoperdaceae	67	121	
	Hymenogastraceae	5	10	
	Total	111	174	56.7
Hypodermeae	(Aecidiomycetes)	49	101	106.1
Ascomyceteae —	Tuberoideae	2	4	
	Discomyceteae	84	134	
	Hysteriaceae	4	12	
	Pyrenomyceteae	90	190	
	Total	180	340	88.9
Phycomyceteae		4	12	200.0
Fungi Imperfecti —	Sphaeropsideae	8	114	
	Hyphomyceteae	47	114	
	Total	55	228	314.5
Myxomycetes	32	48	50.0	
	Total fungi	**1,215**	**2,077**	**70.9**

such a large expanse of country . . . Interested persons will possibly take exception to the omission of the names of collectors under each individual species, but as this could not be done for lack of the necessary information in all cases, it was considered advisable not to attempt it in any. Moreover, this could hardly be classed as 'scientific information' and would in no way have contributed to the practical value of the volume.

For many years this was the standard text on Aus-tralian fungi. As was the case with higher plant taxonomists using Bentham's *Flora australiensis* (1863–1878) Australian mycologists later experienced difficulties in establishing species locations and herbarium specimens. In a monograph of the Australian species of *Amanita* Pers. ex Hook., D. A. Reid (1979, p. 1) commented:

> It is a sobering thought that, hitherto, anyone wishing to name an Australian *Amanita* had to resort to M. C. Cooke's *Handbook of Australian fungi.* This provided minimal microscopic data . . .. limited to spore size with occasional mention of spore shape. These meagre data were totally unreliable and misleading.

A group of little known parasitic fungi, the black mildews, further illustrates the relationship between fungal taxonomy in the late 19th century and today. At present, this group of melioline fungi (Meliolaceae) in Australia consists of four genera and over 100 species (Parbery, unpubl.). Cooke (1892) and Bailey (1893) listed a total of 11 species of *Meliola* Fr. on various host plants in Australia. These are summarized in Table II, together with the meagre data supplied by these authors concerning host range and distribution, and an outline of the present taxonomic status of each fungus. The summary indicates that *M. densa* Cooke remains as the only legitimate name of an Australian melioline fungus and *M. polytricha* Kalch. & Cooke has been placed in synonymy. All other original names have either been discarded or are invalid, misapplied, transferred or are *nomina dubia.*

By the end of the 19th century a considerable amount of interest and expertise in mycology had developed in Australia. Some ideas for the future were aptly stated by J. H. Maiden (1895, p. 29):

> More attention is being directed, at the present time, to the fungi, particularly the micro-fungi, on indigenous plants. Many of them are quite minute, and look like mere discolourations of the leaves, etc. Much more attention has been given in Victoria and Queensland to the collection of these lower forms of plant-life, and we would like to invite the attention of observers all over the Colony to this matter, and to state that careful search will probably be rewarded by the discovery, not only of species of micro-fungi new to the Colony, but also new to science.

Table II
Notes on species of *Meliola* Fr. recognized as occurring in Australia by Cooke (1892) and Bailey (1893)

1. ***M. amphitricha*** Fr.
   * 'On leaves of *Cupania, Eucalyptus* and *Flindersia.* Victoria, Queensland.'
   # 'Abundant on the foliage of indigenous shrubs'.
The epithet has been discarded (Hansford 1961) as no type specimen or host can be assigned to the 'species'. It seems that this name was formerly applied to most black mildews.
2. ***Meliola corallina*** Mont.
   * 'On leaves, Queensland.'
   # On foliage of shrubs in mountain scrubs.'
Found on *Drimys* spp. in South America but has not been observed on *Tasmannia* spp. or related plants in Australia.
3. ***Meliola orbicularis*** B. & C.
   * 'On branches and leaves, Queensland.'
   # Not mentioned.
A herbarium specimen (*Bailey 831,* BRIP) consists of a fungus growing on bark from an unidentified tree in the Mt Bellenden-Ker area, Queensland. Hansford (1961) considered the fungus not to be a *Meliola* sp. and to probably belong to a new genus. It is still awaiting determination.
4. ***Meliola loganiensis*** Sacc. & Berl.
   * 'On leaves of *Smilax*, Queensland.'
   # On the leaves of a *Smilax*.'
Transferred to *Zukalia* by Saccardo (1891) and doubtful if the type collection exists.
5. ***Meliola octospora*** Cooke
   * 'On leaves, Queensland.
   # On foliage of the Brisbane box, *Tristania conferta.*'
Transferred to *Meliolina* Syd. (= *M. cladotricha* Lév.).
6. ***Meliola mollis*** B. & Br.
   * 'On leaves, Queensland.'
   # 'On eucalypt leaves.'
Transferred to *Meliolina* [= *M. mollis* (Berk. & Br.) Höhnel].
7. ***Meliola tetracerae*** Thum.
   * 'On leaves of *Tetracera wuthiana*, Queensland.'
   # 'On foliage of *Tetracera wuthiana*, Daintree River.'
Doubtful if any type collection exists and there are no records of a *Meliola* sp. on the host. Saccardo (1889) referred it to *Limacinia* Neger.
8. ***Meliola eucalypti*** Cooke
   * Not mentioned.
   # 'On plant specimens sent to Mueller.'
There is no record of Cooke publishing this name. Stevens and Roldan (1935) used the epithet when naming a *Meliola* on *Eucalyptus* sp. in the Philippines.
9. ***Meliola densa*** Cooke
   * 'On *Eucalyptus* leaves, Queensland.'
   # 'Found on plant specimens sent from Queensland to Baron Mueller.'
Found on *Eucalyptus* spp. in northeast Queensland.
10. ***Meliola polytricha*** Kalch. & Cooke
   * Not mentioned.
   # 'On leaves of *Callistemon*, Queensland.'
   Now known as *M. queenslandica* (E. Fisher) Hansf. Found widely on *Callistemon* spp.
11. ***Meliola musae*** Mont.
   * 'On *Musae*, Queensland.'
   # 'On foliage in mountain scrubs.'
Recorded on *Ravenala* and *Heliconia* spp. in Central and South America. No *Meliola* spp. known on *Musa* spp.

* Denotes that information is from Cooke (1892).
# Denotes that information is from Bailey (1893).

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History of systematic mycology in Australia

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Abstract

The history of systematic mycology in Australia revolves around the contribution of Daniel McAlpine. Prior to McAlpine's appointment in 1890 to the Victorian Department of Agriculture almost all collections of Australian fungi had been sent to and named by mycologists at Kew. McAlpine established the first mycological herbarium in Australia between 1890 and 1911, and described 320 new species and six new genera, mostly of pathogenic fungi. After McAlpine, systematic mycology was largely neglected, apart from work on the larger fungi by J. B. Cleland in the 1930s, until a few plant pathologists beginning in the 1950s and 1960s revived the study of fungal taxonomy. The majority of mycological specimens today are lodged in about six herbaria, but only half of these have active taxonomists/curators. There are fewer than ten full-time fungal taxonomists working in Australia. The reasons for this neglect of fungal taxonomy are discussed in the light of economic importance and the numbers of fungi relative to other plant groups.

The history of systematic mycology in Australia can be conveniently divided into four eras, largely circumscribed by the contribution of one man, Daniel McAlpine, as follows:

1770–1890: pre-McAlpine era
1890–1916: McAlpine era
1916–1960: post McAlpine era
1960 onwards: present era

The pre-McAlpine era was a period of very little mycological activity in Australia, and most collections of fungi were sent by botanical collectors to European (mostly British) mycologists. By 1895 (McAlpine 1895a) about 2,000 fungi had been recorded from Australia. The pre-McAlpine era is discussed in detail by Parbery & Sheather (this volume) and May (this volume) has discussed the history of the taxonomy of Australian Agaricales. My discussion is limited to the period after 1890, and concentrates on microfungi in the context of plant pathology, with only occasional references where appropriate to other groups of fungi.

The appointment in 1890 of Daniel McAlpine as Consulting Vegetable Pathologist to the Victorian Department of Agriculture was due more to phytopathological necessity than to an appreciation of the need for increased taxonomic activity. Severe epidemics of rust in wheat in the 1860s had led to the establishment of a committee chaired by Ferdinand Mueller to enquire into the effects of agricultural practices on the severity of the disease. This committee recommended early sowing and careful selection of wheat varieties as a means of control. Another severe epidemic of rust in 1889 was followed by the first national Rust-in-Wheat conference in 1890. This conference recommended an accelerated programme of experimental work and almost certainly led to the appointment of Daniel McAlpine in May 1890 (Fish 1976).

Daniel McAlpine

McAlpine was born at Saltcoats, Ayreshire, Scotland on 21 January 1849 and studied science at the Royal School of Mines, South Kensington under Thomas Huxley. He married in 1878 and after having lectured in biology and botany for eight years in Edinburgh travelled to Melbourne where he arrived in 1884. In 1885 he was appointed as Lecturer in Botany and Biology at Ormond College, University of Melbourne and as Lecturer in Botany at the College of Pharmacy in 1886, the latter position being held until 1911. On 12 May 1890 he was appointed Consulting Vegetable Pathologist to the Department of Agriculture, Victoria, at a salary of £200 p.a. with instructions to inquire into 'matters appertaining to Rust in wheat' and 'other matters which may form subjects of enquiry' (letter of appointment on display at PRI, Burnley).

He immediately embarked on an ambitious programme of experimental work, establishing trials on wheat in all parts of the state, with the co-operation of farmers and departmental staff. However, he held a very strong view that experimental work on a disease must not be carried out in isolation from an understanding of the taxonomy of the causal organism and its relatives. Consequently he held that it was necessary to study not only the wheat rust organism (*Puccinia graminis*) but all rusts on all Australian plants and he extended this philosophy to all groups of fungi with which he dealt. Taxonomically he commenced with the preparation of his *Systematic arrangement of Australia fungi* (McAlpine 1895a) in which he listed 2,284 species of fungi. During the next 20 years he was to add over 320 new species and six new genera to this list as well as numerous new records. The first new species described by him was *Laccocephalum basilapiloides* McAlp. & Tepper, a stipitate polypore arising from a large subterranean sclerotium. Thereafter he concentrated his taxonomic efforts almost exclusively

on plant pathogenic microfungi, publishing 226 papers, (mostly in Australian journals), numerous annual reports, and six books (McAlpine 1910). *The rusts of Australia* (1906) and *The smuts of Australia* (1911) are his best known and most influential books and remain standard works on their respective subjects today. In the former publication McAlpine increased the number of known rusts from 72 known in 1892 (Cooke 1892) to 161, of which 75 were new species described by him. The latter work contained his descriptions of 26 new smuts, bringing the number known for Australia to 68. He also published on diseases of citrus, stone fruits, potatoes, vines, vegetables, apples and pears, as well as numerous papers on fungi from native plants. His herbarium, containing over 9,000 specimens, including his types and a large collection of valuable exsiccatae, is housed in the Plant Research Institute, Burnley (VPRI).

In 1911 McAlpine was seconded by the combined State and Commonwealth Governments to investigate the nature and control of bitter pit of Apples, a storage disorder which was having a serious effect on Australia's export trade in apples. He undertook the work reluctantly, perhaps because he quickly realized that it was of non-pathogenic origin, and was taking him away from other work that he had planned, including a text book on plant diseases in Australia. Nevertheless he undertook an exhaustive investigation of the anatomy and physiology of the apple fruit and published five annual reports up to 1916. He was unsuccessful in finding a solution to the problem. When the funding expired in 1916 he discovered that his old position as Vegetable Pathologist had been given to his former assistant C. C. Brittlebank in 1913, so that McAlpine was in effect unemployed. This upset him greatly and he never returned to taxonomic mycology, instead continuing his private research into bitter pit in collaboration with overseas pathologists. [The causal relationship between calcium deficiency and bitter pit was not implicated until 1936 (De Long 1936) and not generally accepted until the early 60s (Baxter 1962).]

Daniel McAlpine and his wife Isabella retired to a country property at Wandin, east of Melbourne, which they later sold in 1924 in order to live with their five daughters and their respective families. McAlpine died on 12 October 1932 at his daughter Constance McDougall's home at Leitchville and is buried in Cohuna cemetery. Various memorabilia of McAlpine, including photos and biographical notes by his daughter Erica Wedge, are housed in the Plant Sciences Library at Burnley, while much McAlpine correspondence is in the Latrobe Library, Melbourne, and correspondence from William Farrer is in the Mitchell Library, Sydney. A detailed biography was published by Fish (1976). McAlpine is recognized as the father of both plant pathology and taxonomic mycology in Australia and the biennial conferences of the Australian Plant Pathology Society always include a 'Daniel McAlpine Memorial Lecture'.

Other significant contributors to Australian mycology during the McAlpine era were: Nathan Cobb, plant pathologist to the N.S.W. Department of Agriculture from 1890–1905, who published a number of papers on fungi but was best known as a nematologist; L. Rodway, Tasmanian Government Botanist who described several new fungal species between 1890 and 1920; and L. H. Bailey the Queensland botanist who published many papers on fungi.

McAlpine was also ably supported by energetic collectors, including his assistants G. H. Robinson and C. C. Brittlebank, and F. M. Reader of Dimboola.

Post-McAlpine era

The major figures in fungal taxonomy in the period 1916–1960 are listed in Table I. Charles Clifton Brittlebank was McAlpine's immediate successor, but he did not have a major interest in taxonomy, publishing only a few names. Brittlebank's chief concern was the establishment of a viable plant pathology laboratory which eventually became the Plant Research Laboratory at Burnley in 1929 (now the Plant Research Institute). His most significant contribution was a checklist of Australian fungi and their hosts completed in 1940 and given limited distribution. Brittlebank and his successors in the Victorian Department of Agriculture apparently no longer acknowledged the necessity for plant pathology to be supported by fungal taxonomy, possibly in the belief that McAlpine's work had laid a sufficiently solid foundation and that overseas experts could provide any additional support required. It is probably also true that the pressing need for solutions to problems of disease control made taxonomy appear a luxury. Consequently, apart from the few fungi described by Brittlebank and one fungus (*Venturia carpophila*) described by E. E. Fisher (1961), the subsequent fifty years yielded little in the way of taxonomic work from the Victorian Department of Agriculture. Very few specimens, most notably collections of common plant pathogens by A. T. Pugsley, were added to McAlpine's herbarium.

Ethel McLennan was appointed to the School of Botany, University of Melbourne in 1915 and lectured in Mycology and Plant Pathology until her retirement in 1955. Although best known as a plant pathologist and teacher, she published several important taxonomic papers, mostly on non-pathogenic fungi, primarily Clavariaceae (McLennan 1932) and Tuberales (McLennan 1961). Her specimens are held in the herbarium of the Botany School, University of Melbourne (MELU). Her paper on Clavariaceae was followed by two papers by S. G. M. Fawcett (1937, 1939) who described additional species.

Edwin Cheel and John Burton Cleland published together on agarics in New South Wales during the early 1930s and their New South Wales specimens are held in the Rydalmere herbarium (DAR). Later Cleland moved to South Australia, where in 1934 he published his *Mushrooms, toadstools and other larger*

Table I
Major figures in taxonomic mycology, 1916–1960

Name	State	Herbarium
Brittlebank	Vic.	VPRI, CANB
McLennan	Vic.	MELU
Cheel	N.S.W.	DAR, NSW
Cleland	S.A., N.S.W.	AD, DAR
Fawcett	Vic.	MELU
Hansford	S.A.	ADW
Cunningham (G. H.)	Vic., N.S.W. (N.Z.)	MELU, PDD
Walters	Vic.	'CSIRO–Highett'
Willis	Vic.	MEL

fungi of South Australia. His South Australian specimens are held in the State Herbarium of South Australia (AD). Cleland's collections have recently been extensively re-examined by Cheryl Grgvrinovic with a view to publication of a revised edition of Cleland's handbook.

C. G. Hansford was head of the Plant Pathology Department at the Waite Agricultural Research Institute (ADW) from 1951–1958 and during this time concentrated on the taxonomy of fungi, especially Meliolaceae, from Australian plants. He described about 400 species, including 145 new species and two new genera and made 19 new combinations. Hansford's papers and his herbarium at ADW remain essential source material for anyone working on fungi on Australian plants. Use of the herbarium is especially necessary since, although Hansford's published descriptions are excellent, he seldom published illustrations. There is no longer a fungal taxonomist at ADW and the long-term preservation of Hansford's specimens is cause for considerable concern.

Another significant contributor to knowledge of Australian fungi was the New Zealand mycologist G. H. Cunningham, whose many publications on New Zealand fungi often included Australian records. His *Thelephoraceae of Australia and New Zealand* (1963) is especially significant in this respect. Most of his large herbarium is in Auckland (PDD), although some Australian collections are in MELU. The Victorian mycologist N. E. M. Walters amassed a large collection of wood rotting fungi, mostly Aphyllophorales, and his specimens and cultures are held at the CSIRO Division of Building Research in Highett, Victoria. Unfortunately there is no taxonomist at this herbarium now and the future of the collection, especially the culture collection, is in doubt. James H. Willis, the well-known Victorian botanist, collected larger fungi over many years and published a number of papers in the *Victorian Naturalist* and a field guide to toadstools and mushrooms (Willis 1957). His collections are at the National Herbarium of Victoria (MEL).

Numerous other plant pathologists and botanists collected and published on fungi during the post-McAlpine period but there were very few professional, full-time fungal taxonomists in the country who made a significant contribution to our knowledge of Australian fungi. The exceptions are J. B. Cleland, G. H. Cunningham and C. G. Hansford. There are of course scattered references to Australian fungi published by overseas taxonomists but these contributions are outside the scope of this paper.

The present

I have dated the present period from 1960, partly because most taxonomists still active started to contribute to Australian taxonomy after 1960, and partly because John Walker began his taxonomic work in the early 1960s. Walker has been the major influence on fungal taxonomic work in Australia for more than 20 years, especially in terms of the organisation of mycological work and as a stimulatory influence on many individuals with an interest in taxonomy. He has built up DAR into the most important fungal collection in the country, and been instrumental in gaining recognition by the Standing Committee on Agriculture of the three major mycological herbaria (DAR, VPRI, BRIP) as the National Collection of Fungi.

In 1980 Walker produced a list of mycological herbaria and culture collections in Australasia (Walker 1980a). Table II is a list of the most important herbaria from that list containing 70% of fungal specimens held in Australian herbaria, updated where appropriate to the present day. The most remarkable point to be made from this list is that, of the eight herbaria listed, only three have active taxonomists associated with them and only four are actively curated. All of those with taxonomists are Department of Agriculture (or Primary Industries in Queensland) institutions dedicated to plant pathology research. The other actively curated collection is MELU which although only a small collection contains material from a number of important collectors and is currently accessioning the collections of H. J. Swart and G. Beaton.

Taxonomic activity in DAR, BRIP and VPRI arose because individuals, originally appointed as plant pathologists, developed an interest in fungal taxonomy and persisted (in some cases against considerable opposition) until taxonomy and herbarium curation became their accepted roles. Michael J. Priest, appointed to DAR in 1982 is perhaps the only mycologist in Australia appointed specifically as a taxonomist. John Walker has published in a wide range of taxonomic groups but a major contribution has been in unravelling the complicated taxonomy and nomenclature of the cereal take-all fungus *Gaeumannomyces graminis* and its relatives (Walker 1980b), work that has had worldwide acceptance. John Alcorn, at BRIP, has published mostly on *Drechslera* and its segregates, with a major paper (1983) on generic delineation in the group. My own interests are in *Fusarium* taxonomy and in the taxonomy of fungi on native plants. All three herbaria concentrate on plant pathogenic microfungi, but in keeping with their joint role as the

Table II
Principal mycological (non-lichen) herbaria in Australia

Herbarium	Locality	Specimens	Collectors	Taxonomists	Curated
AD	Adelaide, S.A.	9,000	Cleland	0	
ADW	Glen Osmond, S.A.	16,500	Hansford	0	
BRIP	Indooroopilly, Qld.	17,000	Alcorn, Langdon, Bailey, Simmonds	1	*
DAR	Rydalmere, N.S.W.	74,000	Walker, Fraser	2	*
MEL	S. Yarra, Vic.	18,500	Willis	0	
MELU	Parkville, Vic.	2,500	Swart, McLennan, Beaton, Fawcett	0	*
VPRI	Burnley, Vic.	16,000	McAlpine, Sutton, Pascoe	1	*
'CSIRO'	Highett, Vic.	9,000	Walters	0	

* Collections which are actively curated at present.

National Collection of Fungi, hold specimens from all groups of fungi, whether economically important or not.

In all of these agriculture-orientated herbaria the role of the taxonomist/curator embraces diagnosis and identification services, for both scientists and the general public, curation and loan administration of herbarium specimens and culture collections, provision of plant disease checklist data for quarantine and trade authorities, provision of advice to a range of individuals on the biology, pathology and distribution of fungi, and on techniques of culture and microscopy for plant pathologists. Taxonomic research invariably is relegated to a spare-time activity and the publication rate of these individuals is not as high as might be expected if taxonomic research was their principal activity.

The only herbaria associated with botanic gardens, and with substantial mycological collections, are AD and MEL. Neither has a mycologist on staff and no other state herbarium in Australia has a mycologist. AD contains the important Cleland collection of large basidiomycetes. MEL contains the second largest mycological collection in Australia but it has never been curated or catalogued and the large collection of exsiccatae is virtually inaccessible due simply to the impossibility of knowing what is there or how to find it. Willis's collections of basidiomycetes are similarly unsorted and uncatalogued. The collection has been static for decades. All the non-lichenised fungi in the National Herbarium of New south Wales (NSW) were transferred to DAR in the mid-1970s.

In addition to the herbaria listed above, two large culture collections deserve mention. The CSIRO Food Research Laboratory (FRR) at North Ryde has a very large culture collection of food spoilage organisms, especially *Penicillium*, on which genus J. I. Pitt is a leading world authority. Pitt is supported by Ailsa D. Hocking who curates the culture collection and also conducts research on the taxonomy of *Penicillium* and related genera. It is one of the most important collections of *Penicillium* and related genera in the world and contains isotype cultures of almost all *Penicillium* names. The collection is almost exclusively composed of living cultures, the few dried specimens mainly being lodged in DAR. The culture collection of the Department of Plant Pathology and Agricultural Entomology, University of Sydney contains over 3,000 isolates of *Fusarium*. Lester W. Burgess and students are involved with the ecology and taxonomy of this agriculturally important genus.

H. J. Swart, Botany School, University of Melbourne, has been an especially significant contributor to knowledge of fungi on leaves of native plants and is regarded as the outstanding mycological illustrator of recent decades. His series entitled 'Australian leaf-inhabiting fungi' in *Transactions of the British Mycological Society* consists of 29 papers (some still in press), describing many new species and genera and resolving a number of outstanding taxonomic and nomenclatural problems with Australian fungi. Swart retired in December 1987, and his specimens are in MELU.

Other taxonomists active between 1960 and the present include R. F. N. Langdon (Ustilaginales and Clavicipitales), D. G. Parbery (graminicolous *Phyllachora* spp.), P. H. B. Talbot (Aphyllopharales), G. Beaton (Discomycetes and hypogeal Gastcromycetes), G. A. Kile (*Armillaria*), I. H. Parbery (Meliolales), J. E. C. Aberdeen (Agaricales), R. N. Hilton (Agaricales), C. J. Shepherd (Agaricales), J. H. Warcup (*Rhizoctonia* and related fungi), A. E. Wood (Agaricales) and D. H. Ellis (medical mycology). It can be seen that only a few of these have been involved with plant parasitic microfungi.

The neglect of fungal taxonomy

Currently active taxonomists (all groups) are listed by Australian Biological Resources Study (ABRS) (1987). An analysis of this list (excluding lichenologists and with some adjustment for recent retirements and deaths) yields a maximum of 15 Australian fungal taxonomists, although there are probably less than ten full-time professional taxonomists. If this is compared with ABRS figures for other groups of plants (Table III) the figures show a startling paucity of fungal taxonomy in this country. This, coupled with past neglect of mycology, means that our collective knowledge of Australian fungi lags far behind knowledge of other groups. Major groups of flowering plants, mosses, ferns and marine algae are almost completely known for the country. The disproportionate amount of taxonomic research being undertaken in some groups amounts to little more than fine tuning of classifications in which the majority of taxa are well known and clearly delineated.

The relative under-representation of fungal taxonomists would be understandable if fungi were either economically unimportant or numerically insignificant. They are patently not either of these! Fungi cause 90% of plant diseases and diseases cost Australian agriculture over $2,000 million every year. And this does not include fungi involved in forestry, food spoilage, biodeterioration, mycotoxins, human and animal diseases, fungal poisoning, fermentation industries, drug production, and mycorrhizae. Of course if one shied away from economic criteria as a measure of the importance of plants one can still argue that fungi are of paramount ecological importance.

It is difficult to obtain estimates of the number of fungi but the following statistics should help to relate fungal numbers to vascular plant numbers. An Australian checklist on diseases of vegetable crops (Morschel 1975) lists 635 fungal diseases on 63 taxa of crop plants, plus 755 diseases not yet recorded in Australia. Note that the number of fungal taxa will be less

Table III
Numbers of plant taxonomists, extracted from Australian Biological Resources Study (1987), *Register of taxonomists and biogeographers*

	No. of taxonomists	Approx. no. of Australian spp.
All plants	358	25,000
Myrtaceae	57	1,500
Eucalyptus	25	600
Ferns	19	350
Algae	28	1,100*
Mosses	19	1,300
Lichens	11	2,300
Fungi (non-lichen)	15	c. 10 x plant spp.

* No. of benthic algae in southern Australia.

than the number of diseases since some fungi have broad host ranges. The *compendium of strawberry diseases* (Maas 1984) lists 50 fungal diseases on *Fragaria*, 50% of which are caused by fungal taxa unique to strawberry. The *Compendium of wheat diseases* (Wiese 1977) lists 36 fungi for *Triticum*, while the *Compendium of corn diseases* (Shurtleff 1980) lists 38 foliar and inflorescence fungi for *Zea mays*. Our recent work (Sutton & Pascoe, unpubl.) on fungi from Australian plants yielded 912 specimens in the first six months, comprising 268 plant taxa, from which we identified 514 fungal taxa. *Acacia* s. lat., of which we collected 71 species, yielded 94 fungal taxa, at least 45 of which are new to science. On the 13 species of *Banksia* collected from southeast Australia we identified 55 fungi from leaves alone. We know that our knowledge of *Banksia* fungi is more complete than for other genera because we find fewer new species now, but we are also aware that we have not looked at fungi from twigs, fruit, bark, litter, or wood or Western Australian species, and the ratio of fungal species to host species is already 4:1. So we have a range of ratios of fungal species to host species of from 25:1 in the case of strawberry, a completely studied host, to less than 2:1 for *Acacia*, on which we are still finding many new species, and this is without considering saprophytes, litter decomposers, endophytes, epiphytes, or mycorrhizae. It is hard to escape the conclusion that there are at least ten times as many fungi as vascular plants, and this means over 250,000 for Australia, of which we probably know fewer than 5%. There are fewer than 15 active fungal taxonomists which must be compared with 25 eucalypt taxonomists working on a group with only 600 species, and 19 fern taxonomists on a group with only about 350 species (ABRS 1987). So we are certainly not in a position where we could, group by group, complete the fungal volumes of *Flora of Australia* in the foreseeable future. We could probably write a handful of volumes, on groups such as the Uredinales and Ustilaginales, and Meliolales, but in many other groups so much remains to be done that we can scarcely be said to have begun.

What then are the reasons for this extraordinary neglect of the taxonomy of such a large and important group as the fungi? Why are there no mycologists employed by any herbaria associated with botanic gardens? Why do so few university Botany Departments teach fungal taxonomy? McAlpine (1895b) was also concerned about the neglect of mycology and made the following comments:

> The reason for the fungi being so little known and comparatively neglected, in contrast to the higher divisions of the vegetable kingdom, are various. They are not as a rule, an attractive group, and the ordinary investigator passes them by. They are likewise somewhat difficult to determine, usually requiring the use of the microscope for that purpose...

He seems to have assessed the situation admirably. In terms of perceived attractiveness, fungi suffer from a kind of inverse 'cute and cuddly syndrome'. This is that syndrome that suggests that large, visible, attractive, benevolent organisms are more worthy of study than small, ugly, malevolent or technically demanding organisms. Likewise it is the syndrome that causes hordes of amateur naturalists to become bird watchers or butterfly collectors, and that causes orchids to be the most eagerly embraced group in amateur botany circles. It is sad to think that this syndrome affects the setting of priorities in professional taxonomic research, but I believe it does. Since taxonomic research is seldom directed but occurs by individuals studying the groups to which they are most attracted, taxonomic endeavour is invariably dictated by conspicuousness, attractiveness and accessibility. Perhaps the direction being given to taxonomic research by ABRS will help correct this imbalance.

Macrofungi, although frequently conspicuous in the field, often discourage serious study because modern taxonomy is based largely on microscopic criteria and because of the lack of readily accessible literature on Australian species. Microfungi are often all but invisible in the field and are frequently collected on the basis of symptoms. Detailed laboratory study under dissecting and compound microscopes is necessary before the fungus can be seen and studied. Thus amateurs are frequently discouraged from mycology because they cannot afford microscopes, do not have the skill required for preparation of good microscope slides, or cultures, and find the literature too large and the terminology too complex. Other than the costs of microscopes, the same factors regrettably often militate against the involvement of plant pathologists and botanists in fungal taxonomy.

Taxonomic mycology has been the 'Cinderella' of botanical sciences in this country ever since Joseph Banks and his colleagues on Cook's voyage of discovery marvelled at the strange new plants and animals of Australia but failed to collect any fungi. Whether as a branch of botany or biology generally, mycology will continue to lag behind other disciplines as long as it remains almost exclusively the province of agricultural department plant pathologists and a few academics, whose other duties minimise the opportunity for research and often dictate a concentration on fungi of agricultural significance. University botany departments must reverse their declining support of taxonomic mycology, not only so that botanists can gain some awareness of mycology at the undergraduate level, but also so that more research into the taxonomy of non-economic fungi can be undertaken at a postgraduate level. However, I believe that the most urgent need is for herbaria associated with botanic gardens to appoint mycologists. Unless this need is recognized, and until the funding of mycological research becomes a priority outside of agriculture, there is very little hope that the fungi will ever be substantially represented in the *Flora of Australia*.

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History of the Study of Australian Agaricales

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Abstract

Three periods in the naming of Australian agarics can be distinguished. Initially, during the era of discovery, exploration and early settlement (1788–1838), few agarics were collected and no new species were described. Subsequently (1839-), local collectors were mobilized and a large number of collections were sent to Europe for identification. From 1899 resident taxonomists, notably J. B. Cleland and E. Cheel, began to describe new species, but the pattern of the previous period continued. Important factors affecting the progress of Australian agaricology have been (1) the seasonal, sporadic and ephemeral fruiting of agarics, (2) the difficulty of preservation, (3) the need for detailed notes on fresh material, (4) the importance of microstructure in taxonomy, and (5) the reliance on overseas expertise. The activities of H. T. Tisdall are discussed in relation to such problems.

The Agaricales (agarics) include the fungi commonly known as mushrooms, toadstools and boletes. Agarics may be present in large numbers in suitable habitats in season and they exhibit a variety of form and colour which makes them a conspicuous component of the mycoflora, especially in comparison to many of the microfungi.

A little over 1,000 species of agarics have been reported from Australia to date. Of these, about half are species described from Australian type localities with the remainder being records of species originally described from elsewhere (May & Wood, unpubl.). It is difficult to provide an estimate of the number of Australian agarics but, based on comparison with the mycofloras of other regions and extrapolation from current revisions of particular genera, there are likely to be well over 3,000 species.

Little is known of the naming and use of Australian agarics by the aborigines. Ethnographic data on fungi are scarce and there are virtually no references to specific species of agarics. The following account concerns the naming of Australian agarics since European colonization, with the focus being on those factors which stimulated or hindered the advance of Australian agaricology.

The progress of the naming of Australian agarics is summarized in Fig. 1, which shows the number of new taxa of Agaricales described, by decade, since 1788. The circumscription of the Agaricales is that of Singer (1986) with the exception of the Polyporeae. The information is derived from a census of Australian agarics (May & Wood, unpubl.). In general, the records of species described from elsewhere which were newly recorded from Australia follow a similar pattern.

Discovery, exploration and early settlement (1788–1838)

In comparison to the rich harvest of new and often strange species of plants and animals described during the first fifty years after the European settlement of Australia collections of fungi are rarely recorded. The only new species of fungus to be described was the especially bizarre gasteromycete *Aseroe rubra* Labill.

Soon after British settlement White noted that 'a toadstool was picked up by one of our company, which, some of the natives perceiving, they made signs for us to throw it away, as not being good to eat' (White 1790, p. 166).[1] Later reports are similarly cursory and there are incidental references to agarics in the diaries and accounts of A. Cunningham (Lee 1925), Backhouse (1843) and Leichhardt (1847).

The paucity of references to agarics in the narratives of voyages of discovery and exploring expeditions can be attributed primarily to the seasonal and sporadic occurrence of agarics. Fruiting bodies appear predominantly in autumn and winter in temperate regions and then only if suitable rain has fallen. In the arid areas, in which much of the land exploration was concentrated, fruiting of agarics is rare.

Fungi were not recorded at all by some of the exploring parties. Leschenault (1816), in the account of the voyage of *Le Géographe* and *Le Naturaliste* (1800–1804) under Baudin, attributed the lack of fungi and other cryptogams to the aridity of the soil and the dryness of the climate. Gaudichaud, discussing the results of the voyage of *L'Uranie* and *La Physicienne* (1817–1820) under Freycinet, commented that, although fungi were collected elsewhere, 'New Holland, at the two extremities eastern and western did not offer to me a single species' (Gaudichaud 1826, p. 165). However, fungi were encountered by those who were in the right place at the right time. Peron, also a member of the Baudin expedition, found that on King Island 'the fern-families, the mosses and the fungi have a great number of species as beautiful as they are vigourous; this seems to me to result from the constant humidity of the atmosphere and of the ground' (quoted by Micco 1971, p. 11). Grey, in the journal of his expedition to north-west and western Australia (1837–1839) noted that 'the different kinds of fungus

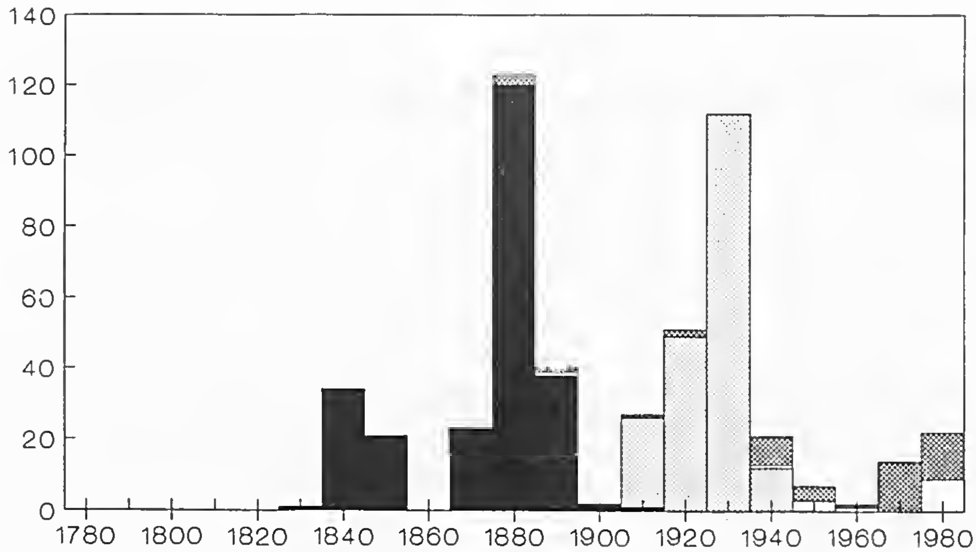

Fig. 1. Number of new taxa of Australian Agaricales described per decade from 1780–1789 to present. Authors are indicated as follows: ■ – Berkeley, Broome, Cooke, Fries, Kalchbrenner, Massee; ▒ – Cleland, Cheel; ▩ – other overseas authors; □ – other Australian authors.

are very good. In certain seasons of the year they are very abundant, and the natives eat them greedily' (Grey 1841, p. 294).

The only named species of agarics recorded during this period were the three species included by Brown (1814) in a list of fungi common to Australia and Europe which had been collected during the voyage of the *Investigator* (1801–1803) under Flinders. Interestingly, amongst Brown's notes on Australian plants[2] there are some descriptions of fungi including an agaric collected from the Kent Group, Bass Strait, in 1804. The collection is noted as emitting a bluish-white phosphorescence and there is also a detailed description, in Latin, of the fruiting bodies. The description clearly refers to *Pleurotus nidiformis* (Berk.) Sacc., not formally described until 1844. This common luminescent agaric, known as the 'ghost fungus', appears to have been named at least four more times since under the appropriate epithets *P. lampas* (Berk.) Sacc, *P. illuminans* (F. Muell.) Sacc., *P. candescens* (F. Muell.) Sacc. and *P. phosphorus* (Berk.) Sacc. Although there are many references to the ghost fungus in both popular and scientific literature (Willis 1967) the correct generic placement and synonymy has yet to be established and there is still no description available which includes the information on macro- and micro-characters necessary in the modern taxonomy of the Agaricales. Brown's notes, in fact, contain more information than some of the type descriptions of the above-mentioned species. Brown's interest and expertise were certainly not restricted to 'higher' plants and he was also well acquainted with the cryptogamists of the day (Mabberley 1985). However, there are no published references to any of his manuscript descriptions of Australian fungi, although specimens may not have been preserved.

The absence of taxonomic publications on agarics during this period was probably due, apart from lack of material, to the scarcity of specialists who were competent to name exotic fungi and who also might have encouraged their collection. The major taxonomic mycologists at the time were C. H. Persoon (France) and E. M. Fries (Sweden) who did publish on extra-European material, but generally that provided by non-British collectors. Significantly, the first comprehensive account of British fungi was that of Berkeley (1836), and it was the Rev. M. J. Berkeley who began the taxonomic study of Australian agarics.

Resident collectors and overseas taxonomists

Berkeley (1839) described *Favolus pusillus* Fr. var. *pallidus* Berk. [= *Dictyopanus pusillus* (Pers.) Singer] and recorded a collection of *Lentinus villosus* Klotzsch, which he subsequently (Berkeley 1840) named *Lentinus fasciatus* Berk. [= *Panus fasciatus* (Berk.) Pegler]. The two species were based on material collected by R. C. Gunn and R. W. Lawrence in Tasmania and were the first new species of agarics to be described from Australia.

The rapid increase in the number of new species described from 1839 (Fig. 1) is attributable to the mobilization of resident collectors who, in contrast to the random activities of preceding collectors, were able to gather agarics wherever and whenever they occurred. The collections were forwarded to European mycologists by correspondents who played an important role in recruiting and supporting the collectors and also in making contact with mycologists. At first, William Hooker (Royal Botanic Gardens, Kew) acted as an intermediary between Berkeley and the collectors J. Drummond, Gunn, Lawrence and W. Archer. The new species forming the initial peak between 1839 and 1860 (Fig. 1) are based mainly on the collections of William Hooker's recruits, with some collections being contributed by J. D. Hooker as a result of the voyage of HMS *Erebus* and HMS *Terror* (1839–1843). During this period Berkeley, with the exception of agarics collected by L. Preiss and named by Fries (see Parbery & Sheather, this volume), described all new species.

William Hooker encouraged the collectors to send fungi, noting in a letter to Berkeley that 'there has arrived today for me a parcel of fungi from Swan River . . . if you could find time to draw out a list of the present ones . . . it would encourage him [Drummond] to persevere in collecting these things more than any-

thing else' (quoted by Galloway 1977, p. 501). Drummond wrote to William Hooker 'You observe . . . that the *Fungi* of this land must be worth picking up. They do exist, indeed in great variety, and some are highly curious' (Drummond 1842, p. 215).

However, European taxonomists had some difficulties with naming Australian agarics. Berkeley, in reference to some collections sent by Drummond, stated that 'the list of agarics would have been much longer had not the notes belonging to many species been lost and the specimens much corroded by insects' (Berkeley 1845, p. 42). In a letter to William Hooker, Drummond noted that 'some sort of mould got amongst my collection . . . and destroyed many of them' (quoted by Galloway 1977, p. 501). Following collection the putrescent fruiting bodies of most agarics must be thoroughly dried — even then they are very susceptible to attack by insects and other fungi.

In the second half of the 19th century the role of intermediary shifted to correspondents resident in Australia, the most important of whom were Ferdinand Mueller (Melbourne) and F. M. Bailey (Brisbane) and this made communication with local collectors much easier. Both Mueller and Bailey passed on a large number of agarics from a wide circle of collectors and they also contributed many new species themselves. The collections they forwarded to Europe form the basis for the second peak of activity between 1870 and 1910 (Fig. 1). Most new species (98%) were named by Berkeley, C. Broome, M. C. Cooke and G. Massee, all of whom were based in England, and by C. Kalchbrenner in Hungary.

Cooke published the comprehensive *Handbook of Australian fungi* in 1892, a work that can best be regarded as 'somewhat unsatisfactory' (Ainsworth 1976, p. 230). Cooke did have to contend with material that was 'very wretchedly preserved' and named only 10% of the material which was sent to him from overseas (English 1987, p. 231). But the major problem with his compilation, and the previous works on which it is based, is that all the species had only been seen in the dried condition. In agarics especially, many characters necessary for classification are lost after drying. In introductory remarks to the first decade of his series on exotic fungi 'Decades of fungi' Berkeley had stressed that 'it is much to be wished that collectors of Fungi would take notes of the colour and substance of their species when gathered . . . The value of such annotations can best be appreciated by those who have to contend with all the difficulties which arise in the examination of exotic forms; difficulties which are multiplied ten times in the genus *Agaricus* [s.l. = Agaricales]' (Berkeley 1844, p. 185). In the introduction to his *Handbook*, Cooke was still emphasizing these points: 'The difficulties in the way of determination or description from dried specimens, especially of Agaricini, badly preserved, with no information, and destitute of figures, are almost insurmountable. Errors are almost inevitable in such cases, and there is never so much certainty or satisfaction as when the specimens can be seen living, or in a fresh state . . . Rarely have the specimens been carefully dried, and much more rarely have they been accompanied by any notes or figures' (Cooke 1892, p. vi).

Some of the field notes were excellent (Fig. 2) but in other instances it is obvious that a good deal of imagination had to go into the reconstruction of the appearance of the fruiting bodies as can be seen from a comparison of Bailey's 'rough' sketch (Cooke 1892, p. vi) of *Agaricus avellanus* Cooke & Massee (Fig. 3) and a painting by Cooke of that species (Fig. 4).

In contrast to the 'higher' plants, Australian agarics collected during the 19th century were easily accommodated into existing genera. Berkeley, discussing some of the collections contributed by Mueller, noted that 'The collection on the whole, can scarcely be said

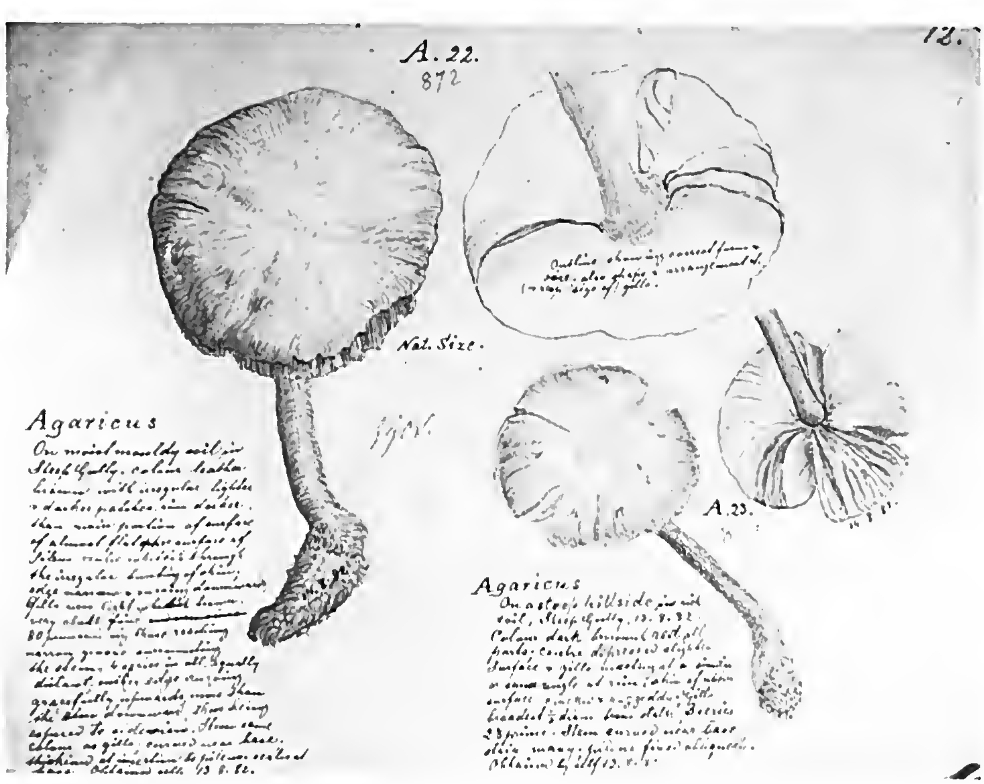

Fig. 2. Notes on agarics by J. G. O. Tepper sent to M. C. Cooke for identification (now in the library, National Herbarium of Victoria).

Fig. 3. F. M. Bailey's notes on the type of *Agaricus avellanus* (accompanying the specimen at the Herbarium, Royal Botanic Gardens, Kew).

Fig. 4. Watercolour illustration of *Agaricus avellanus*, based on Bailey's notes (bound into a copy of Cooke's *Handbook of Australian fungi* in the library, Plant Research Institute, Burnley, Victoria).

to be of any great interest . . . as the aberrant forms are few' (Berkeley 1873, p. 155). The only novel genus from Australia, *Metraria* Cooke & Masse was apparently based on the mixture of a watercolour of an *Amanita* Pers. and the spore print of a *Hebeloma* Kummer (Reid 1980; Holland & Pegler 1983).

Berkeley also found that many of the collections were 'either identical with European species or so nearly allied that with dried specimens only, unaccompanied by notes or drawings it is impossible to separate them' (Berkeley 1873, p. 155). This tendency to place Australian collections under European species has consequently meant that a large number of European species (over 500) have been recorded from Australia. The majority of these records are likely to be incorrect, especially in mycorrhizal genera such as *Russula* Pers. and *Cortinarius* Fr. for which surveys of the comparable mycofloras of New Zealand (McNabb 1973;

Horak 1988b) and South America (Moser & Horak 1975) have found no European species in native forests.

It is not surprising that the dried specimens of agarics, lacking the form and beauty of fresh collections, failed to excite attention. It is only now being realized that the agarics of the Southern Hemisphere, especially those associated with *Nothofagus* Blume, are key elements in understanding the evolution of many genera and generic limits established on Northern Hemisphere species must be altered (Horak 1988a; 1988b).

Apart from a few species whose authorship had been attributed to Mueller by Berkeley and by Kalchbrenner, not one of the agarics included by Cooke (1892) was described by a taxonomist resident in Australia. In contrast, by the end of the 19th century the study of Australian plants by resident taxonomists, such as Mueller, had begun in earnest. A consideration of the activities of H. T. Tisdall illustrates some of the difficulties involved in the establishment of mycological taxonomy in Australia.

Henry Thomas Tisdall

Tisdall was a schoolteacher who spent a number of years at Walhalla in East Gippsland and later resided in Melbourne. He was an active member of the Victorian Field Naturalists Club and was encouraged by Mueller to specialize in collecting fungi (Tisdall 1961). Tisdall made many collections of agarics and other fungi which were forwarded by Mueller to Cooke for description. Tisdall also made the important discovery of the fruiting body of *Polyporus mylittae* Cooke & Massee, for over 40 years only known from its sclerotium, the 'native bread', *Mylitta australis* Berk. (Tisdall 1886).

Many of Tisdall's notes, often accompanied by excellent watercolours (Fig. 5), are now in the library of the National Herbarium of Victoria (MEL). On some of the sheets there are thin slices of the fruiting bodies. Importantly, some of these specimens are holotypes or isotypes of names published by Cooke and Massee, the types of which are usually only sought from the Herbarium, Royal Botanic Gardens, Kew (K). Tisdall's notes are often detailed as can be seen from an extract from those on a collection of *Amanita vaginata* (Bull.: Fr.) Vittad. from Stringer's Creek: 'Volva, thick white, it had evidently enveloped the whole plant which had burst through upwards. Pileus forming a rounded cone, dark brown at apex gradually to pale yellow at the edge, from the edge upwards parallel lines formed by depressions in the testa extend about two thirds of the pileus . . .'. Such information would have been of great value to Cooke, who singled out Tisdall's material, along with that of Miss [presumably Louisa] Wehl and Flora Martin (nee Campbell) as being exceptional amongst the collections he had examined from Australia (Cooke 1892).

The separation between collector and taxonomist meant that some misinterpretation on the part of both parties was inevitable. Tisdall submitted an excellent watercolour of what is obviously *Mycena interrupta* (Berk.) Sacc. (Fig. 6) to Cooke, who did not recognize it despite the existence of a coloured illustration of the type of this distinctive blue agaric in Berkeley (1859). Cooke enquired on the sheet if the colour of the spores were white or pink, and assuming they were pink, identified the collection as a species of *Agaricus* tribus *Leptonia* Fr.. Tisdall (1885) evidently mistook Cooke's enquiry to refer to the colour of the spores under the microscope rather than that of the spore print which would have been the intent of Cooke's query and followed Cooke's identification in later listing *Leptonia lampropus* (Fr.) Quél., noting, however, that 'this fungus is mentioned by Cooke [*Handbook*] as being only found in pastures . . . but I have never noticed them except on trunks of trees' (Tisdall 1896, p. 96). Tisdall's collection of *M. interrupta* predates, by almost fifty years, the first published record of the species from Victoria (Stewart & Hooke 1934: as 'pixie's parasol').

In 'Notes on the genus *Calocera*' Tisdall provided

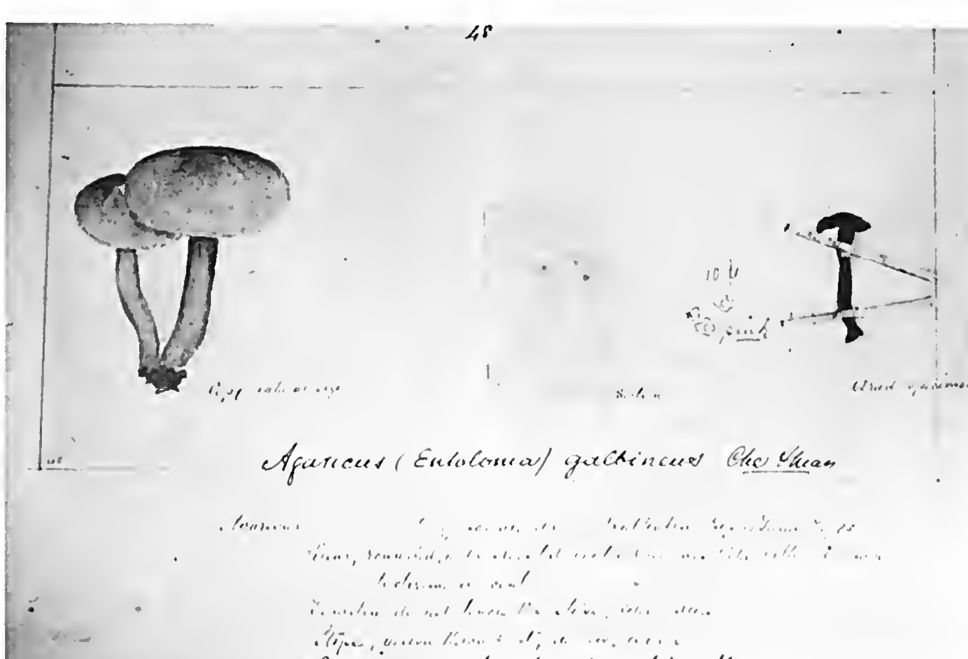

Fig. 5. Isotype of *Agaricus galbineus*, with notes by the collector, H. T. Tisdall (library, National Herbarium of Victoria).

Fig. 6. Notes on an agaric by H. T. Tisdall with annotation by M. C. Cooke (library, National Herbarium of Victoria).

an exhaustive discussion of the macro- and micro-characters of what he considered to be a new species in the genus but concluded that 'still I am uncertain, and would wish to obtain more specimens before asking Baron von Mueller to submit the whole question to Dr. Cooke' (Tisdall 1894, p. 131). He had earlier stated that he was 'content to state such characters concerning fungi which I am in a position to describe, leaving the responsibilities of classification to such veterans in Science as Dr. Cooke and Professor Berkeley'(Tisdall 1887, p. 47). The struggle to transcend deference to overseas experts and establish taxonomy in Australia had already begun for the 'higher' plants, notably by Mueller, but mycology lagged far behind. In discussions after the reading of Tisdall's paper on *Calocera*, Daniel McAlpine, no doubt realizing Tisdall's competence to do so, urged 'the local working out and naming of such additions to our flora' (Anon. 1894, p. 62).

It is notable that Tisdall did examine specimens of fungi with the microscope despite Cooke's contention that 'Australia is not much troubled with microscopical students. Her sons have not yet found time to stand for hours at one end of a microscope' (quoted by English 1987, p. 169). Tisdall was also familiar with the textbooks of De Bary, Tulasne and Berkeley, and often quoted from them in articles which he contributed to *The Victorian Naturalist* and other journals. The tone of these pieces is often didactic and Tisdall shows a good understanding of the contemporary ideas on microstructure: 'Before I proceed, I might explain that the hymenium is composed of a thin membrane completely dotted over with quaternary groups of spores, each spore is borne on the end of a slender stalk or sterigma, and four of these sterigma spring from a . . . basidium . . .' (Tisdall 1885, p. 169). The reliance on microstructures in the taxonomy of the Agaricales has discouraged many subsequent amateur mycologists and it is unfortunate that Tisdall's interest in fungi was not directed towards the publishing of new species and that he did not have the opportunity of more intimate contact with specialists in the field. Lack of ready access to type material and literature would have also been factors discouraging local efforts in taxonomy.

Resident taxonomists

The first new species of agaric to be described by a resident mycologist independently of European specialists was *Hebeloma frenchii* McAlpine (McAlpine 1899). This was the only agaric described by McAlpine who, however, founded Plant Pathology in Australia (Pascoe, this volume). Around the turn of the century Tasmanian botanist, Leonard Rodway, co-authored a number of new species of agarics with Englishman G. Massee, but the peak of new species between 1910 and 1940 (Fig. 1) was almost entirely due to the activities of resident mycologists, J. B. Cleland and E. Cheel.

John Burton Cleland studied medicine, eventually holding the position of Professor of Pathology at the University of Adelaide. He had a life-long interest in fungi, contributing his first article on fungi to his school magazine in 1893 (Southcott 1971) and publishing some notes on fungi in the *South Australian Naturalist* (Cleland 1970) a year before his death. He also made major contributions to other branches of natural history, to anthropology and to conservation (Southcott 1971). Cleland collaborated with Edwin Cheel, Botanical Assistant at the Botanic Gardens, Sydney on a series of papers on Australian fungi between 1914 and 1923. Cleland's continuing interest in fungi resulted in *Toadstools and mushrooms and other larger fungi of South Australia* (Cleland 1934–1935). Cleland made over 16,000 collections of fungi (Talbot 1976), which are now housed at the State Herbarium of South Australia (AD).

In contrast to preceding taxonomists, Cleland and Cheel were able to observe in the field the species which they described, and also had the opportunity to assess the range of variation of fresh material. They

were also careful not to assume that all the species they collected were new. In the introduction to their series 'Australian fungi: notes and descriptions' they stated that 'we have adopted the plan of referring Australian plants to European species if there seems reasonable grounds for considering them the same ... We, however, also add to such identifications our own descriptions of the Australian plants' (Cleland & Cheel 1918, p. 88). Their work is also distinguished by the inclusion of copious notes on the colour of fresh material and some details of spores and other micro-characters as well as discussions of intra-specific variation.

Current research on agarics

Rolf Singer and others have revolutionized the classification of the agarics, producing a system in which the emphasis is on the micro-structure of the fruiting body. Information on cultural morphology, sexuality, interfertility and chemical characters is also of great importance. Cleland's species, and indeed all those of his predecessors, need to be revised according to modern concepts of genera and species but his *Toadstools and Mushrooms* will remain 'outdated and yet timeless' (Talbot 1976, p. 3).

Some of the types of species of agarics described during the 19th century have been re-examined, notably by D. Pegler (K), E. Horak (ZT) and Singer (FH). Such species as *Anthracophyllum archeri* (Berk.) Singer and *Melanotus hepatochrous* (Berk.) Singer, amongst the first to be described, can be considered well known today. However, the majority of named species are known only from the type and there are many dubious records of European species. There is also a large number of undescribed species.

Forty nine agaric species have been described since 1950 (Fig. 1), mostly by overseas taxonomists. At present, in Australian Universities and research institutions there are only four mycologists who have published on agarics. There are also a number of amateur, student or retired agaricologists. Collaboration with, or visits by overseas experts has resulted in significant contributions to the taxonomy of *Amanita* (Reid 1980), *Armillaria* (Kile & Watling 1983) and the gasteroid agarics.

Gasteroid agarics

The gasteroid agarics comprise genera which have long been placed in the Gasteromycetes but which are now recognized as being closely related to the Agaricales. Most gasteroid agarics grow partly or wholly buried and therefore one would expect that they would be even less well known than the epigeal agarics. The knowledge of such fungi in Australia is, however, surprisingly complete. A small number of species were described in the 19th century but currently over one hundred species have been described and these species are for the most part well documented and have often been revised several times. The initial impetus for studies on this group came from Massee who described collections from Rodway. At first Massee published new taxa himself, then Rodway co-authored a number of new species and eventually Rodway himself described more new species. This collaboration was important in shifting the focus of research to Australia. Subsequently, the majority of species in this group have been described by Australasian mycologists, notably G. H. Cunningham, J. Cribb and G. Beaton. Beaton was not a professional mycologist but had a wide interest in the taxonomy of fungi and set up a microscope and library and, with the advice and collaboration of overseas mycologists, described many new species of fungi, especially in the Ascomycetes (Weste 1988). The revision of the Victorian species of gasteroid agarics, commencing with Beaton et al. (1984), is the first comprehensive modern treatment of any group of Australian agarics.

Conclusion

The above account has been concerned with the history of the *naming* of new species of Australian agarics. Naming is by no means knowing and there is much to be learnt about the biology of the species. Agarics are important in forestry (many species are mycorrhizal), in plant pathology (*Armillaria*), and as sources of biologically active compounds. The group also includes choice edible species as well as extremely poisonous ones. Research in these areas is being severely retarded by the lack of taxonomists. Many of the factors which have hindered progress in the past still operate today, the most important being the continual reliance on overseas expertise.

If agarics, and fungi in general, are ever to be given the coverage accorded to the 'higher' plants in the *Flora of Australia*, mycology in Australia must be strengthened considerably. Pascoe (this volume) provides further strong evidence of the neglect of taxonomic mycology in Australia and his call for the appointment of mycologists to State herbaria is strongly endorsed and echoes the plea of McAlpine, almost a century ago: 'There can be no doubt that the necessity for sending specimens, often difficult to preserve, to distant countries for identification has greatly retarded our knowledge of these important organisms [fungi], and I think the time has now arrived when we ought to make an effort to study and develop our own resources' (McAlpine 1895, p. 752).

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Notes

1. The *Coprinus*-like fruiting bodies depicted in plate 33 of White's *Journal*, in the foreground of the illustration of the 'blue frog', are presumably an addition by the engraver, perhaps 'toadstools' for the frogs!
2. These notes are part of Brown's extensive 'manuscript slip catalogue' contained in Solander boxes at the Department of Botany, British Museum (Natural History). There is a microfilm copy at the Australian National Herbarium (CANB).

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Australian plants cultivated in England, 1771–1800

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Abstract

Although it is known that seed of Australian plants was taken to England and Europe from Cook's first voyage of 1769–1771 onwards, there have been few attempts to document the fate of these seeds. One little used source of information is the standard horticultural dictionaries of the early nineteenth century such as Loudon's *Hortus brittanicus*, Sweet's *Hortus brittanicus* and *General history of dichlamydeous plants* by George Don. From these and other contemporary horticultural and botanical sources, a check-list of approximately 170 Australian species cultivated in England in the period 1771–1800 has been produced. A number of species were first described from these cultivated specimens and therefore the documentation of their introduction is important to Australian taxonomic botany. The listing also demonstrates the richness and variety of Australian plants that were grown in England in this very early period of our history.

Over the last 30 years, the fortunes of Australian plants in cultivation have waxed and waned. The fashion, indeed some called it a craze, for growing 'natives' reached its peak in the 1960s and 1970s and has been overtaken in the 1980s by the trend to cottage gardens and the growing of exotics. Yet it is worthwhile reflecting in this, our bicentennial year, that while the cultivation of our plants may be only a recent phenomenon in Australia, it has a history stretching back to before the settlement of this country. Although a final compilation has not been completed, it appears likely that some 3,000–3,500 species of Australian plants have been cultivated in Europe since 1771, while many hybrids, now long lost to cultivation, were also developed. The current collections at the Royal Botanic Gardens, Kew are but a fraction of the plants that have been grown in England and it is interesting to see that some English nurseries are attempting to popularize Australian plants today, one in Dorset having over 300 species in cultivation (Elliot and Jones 1980).

In this paper a brief introduction is provided to the range and variety of plants introduced from Australia to England from 1771, when Lieutenant Cook (as he was then) returned from his first voyage of exploration, up to 1800. Suppliers of seed are identified where possible. The accuracy of published dates of introduction is also discussed. The cut-off date of 1800 was chosen because in this year the major Banksian collector, George Caley, arrived in Australia; his work and that of other official and unofficial collectors will be considered in a subsequent paper. The list of plants introduced up to 1800 is quite amazing — some 170 species from 84 genera and 39 families — and to understand the reason for such interest in Australian plants, it is necessary to consider briefly the garden scene in England in this period.

Georgian England and gardening

Rourke has admirably captured the atmosphere of the Georgian era:

> ... culturally, it was one of the most memorable in English history. In this age of restrained elegance, the arts flourished, while an interest in the sciences gathered momentum. ... Horticulture and landscape design also burgeoned, as did the collecting craze which reached frenzied proportions though it mattered little whether the collectables were fabricated objects or natural history specimens. As regards the latter, George III had set a shining example at Kew where his collection of exotic plants ... generated considerable interest. Indeed, the cult of collecting Cape plants [and those from Botany Bay] fast established itself as a new vogue among the sovereign's more affluent fashion conscious subjects. (Rourke 1980, p. 12.)

Thus, in England in this period there was an eager clientele for strange and exotic plants. One source was South Africa from where Francis Masson had sent home staggering amounts of plant material between 1772 and 1774 and again from 1786 to 1795 (Coates 1969; Rourke 1980). The other was a convict settlement known variously as Botany Bay, Port Jackson or Sydney Cove on the other side of the world. Yet, surprisingly, although Sir Joseph Banks had been appointed Scientific Adviser to the Royal Gardens at Kew in 1772 and was instrumental in the selection of Botany Bay as the site for the new colony, he made no provision for plant collectors or gardeners to sail with the First Fleet when it left England on 13 May 1787.

In his first despatch to England in May 1788, Governor Phillip bemoaned the fact that he 'being without the slightest knowledge of botany (was) without one botanist, or even an intelligent gardener, in the colony' (Phillip 1788). Yet the records show that seeds and plant specimens were received by both Banks and the London nursery firm of Lee and Kennedy with the return of the First Fleet ships in 1789. Thus, despite enormous hardship in its early years, the infant colony was to become an important source of supply of strange and exciting new plants.

The demand for exotic plants prompted commercial nurseries to involve themselves in what was to become a highly lucrative trade. Some of the nurseries which specialized in Australian plants were: Thomas Barr, Islington; Colville and Sons, Chelsea; William Curtis, Brampton; Grimwood and Wykes, Kensington; G. Knight, Chelsea; Lee and Kennedy, Hammersmith; Loddiges and Sons, Hackney; Napier and Chandler, Wandsworth Rd, London; Wm Salisbury, Brampton; Whitley and Brame, Old Brompton (Gilbert 1962). Aristocratic clients of the nurseries, owners of some of the finest glasshouses and conservatories in England, included: Marquis of Blandford; Lord Cremorne; Lady de Clifford; Rt Hon. Charles Greville; G. Hibbert of Clapham; Lady Hume; Viscount Lewishan; Duke of Northumberland; John Ord of Waltham Green; J. Robertson of Stockwell; J. Vere of Kensington-Gore; E. J. A. Woodford of Vauxhall (Gilbert 1962).

These nurseries and their clients vied with one another to introduce and flower new species. As the range of species increased, so did the demand for knowledge of them. Such was the interest that in 1787, William Curtis brought out the first issue of his *The botanical magazine* which set out to be a 'display of the flower garden of ornamental foreign plants cultivated in the open ground, the greenhouse and the stove . . . accurately represented in their natural colours' (Title page of vol. 1). The format was to describe each plant concisely, provide cultivation details and illustrate it with a full coloured plate. Curtis was perhaps fortunate in establishing the magazine when he did as interest in plants and a desire for knowledge of them had been whetted by the fascinating plants, particularly proteas, brought from South Africa. This interest was further developed as the first specimens from Port Jackson became available, many of them 'exceedingly handsom and different from any shrub(s) I ever saw before' (Smyth 1979, p. 79). The circulation of *The botanical magazine* was said to be 3,000 so it is small wonder that plants described in it frequently became household words. The first Australian plant featured was *Acacia verticillata*, plate 110 of 1790, and another ten were illustrated by 1800. In all, some 83 of the nearly 170 plants introduced up to 1800 were included in the magazine up to 1850.

Curtis's format was obviously successful and was followed by others. Henry Andrews commenced *The botanist'srepository* in 1797 (Britten 1916); Sydenham Edwards began *The Botanical Register* in 1815 while the firm of Conrad Loddiges and Sons produced *The Botanical Cabinet* between 1817 and 1833 (Stafleu and Cowan 1976–1988).

By the 1820s and 1830s, popular botanical dictionaries and encyclopaedias claiming to give details of 'all the plants cultivated in England' began to appear. They were immense labours and today are an invaluable record of just what was cultivated in Great Britain during this period. Though they hardly make inspiring reading, consisting largely of tables of data for upwards of 30,000 plant species in some cases, they were obviously popular. For example, John Loudon's *An encyclopaedia of plants*, had several new editions plus re-issues and supplements between 1829 and 1880 (Stafleu and Cowan 1976–1988).

Because of the rigours of the English climate, most plants were grown in either glasshouses or stove-houses. The encyclopaedias usually provided detailed information on cultivation under these conditions and I have previously discussed the particular needs of proteaceous plants (Cavanagh 1982). New Holland plants remained fashionable into the 1840s when they were replaced by tropical shrubs and rainforest plants which required a moist glasshouse atmosphere (Stearn 1984). This spelt the death of most Australian and South African species, Proteaceae in particular, which needed a dry, heated environment (Rourke 1980).

Plants cultivated to 1800

The list of plants in the appendix was compiled in the following manner. Tables in two major encyclopaedias, Sweet's *Hortus britannicus* (1826) and *Loudon's encyclopaedia of plants* (Loudon 1880), were scanned for details of any plant introduced between 1771 and 1800. The preliminary list so compiled was then checked against *Hortus kewensis* (Aiton 1810–1813) and the *General history of the dichlamydeous plants* (Don 1831–1838) and a final check list was prepared, doubtful species being eliminated.

As many of the early names are no longer current, each was then checked against *Index kewensis* (Jackson 1893–) and/or *Flora australiensis* (Bentham 1863–1878). Finally, because more than 90% of the species were collected in the vicinity of Sydney, modern names and authorities were obtained from the third edition of *Flora of the Sydney region* (Beadle *et al.* 1982) while other species were confirmed against relevant revisions and/or floras. Despite these precautions, many of the Myrtaceae, especially *Leptospermum* and *Callistemon*, and some of the pea flowering plants caused much confusion to early botanists and identification is not always precise. The list is as accurate as can be made with our present knowledge.

The appendix includes a column for illustrations which appeared in contemporary magazines such as Curtis's *The botanical magazine* and gardening and horticultural books such as *Paradisus londinensis* (Salisbury 1805–1808) and *A specimen of the botany of New Holland* (Smith 1793). The purpose of this is to provide an index to such illustrations, not all of which are referred to in *Index londonensis* (Stapf 1929–1941). In some cases these illustrations represent the type specimens, no herbarium specimens having survived. Examples include Henry Andrews's illustrations of *Bauera rubioides*, *Crowea saligna* and *Callicoma serratifolia*, all of which were derived from cultivated plants.

The 170 species listed represent 84 genera in 39 families, of which over 90% grew in the Sydney region. In 1924, J. H. Maiden, then New South Wales Government Botanist, produced a list of 45 plants which he believed would have grown in Tank Stream Valley where Phillip made his first settlement (Campbell 1925). Twenty three of these plants were in cultivation in England by 1800 and others were grown later. Among the major families, there were 16 genera of the Papilionaceae, ten of the Proteaceae, and nine of the Myrtaceae, while species such as *Abroma fastuosa*, *Cajanus reticulatus*, *Callicoma serratifolia* and *Calomeria amaranthoides*, not commonly cultivated today,

were plentiful. As not all these plants have particular horticultural merit, the wide range grown perhaps demonstrates that in some cases, curiosity value overshadowed scientific or horticultural aspects in the scramble to grow these strange plants from New Holland.

Accuracy of the records

Figure 1 shows how the introduction of Australian plants was distributed over the 30 years 1771–1800. William Aiton, Gardener to His Majesty at Kew, meticulously recorded the dates of introduction as well as the introducers of many exotic plants. He published this information in the first edition of *Hortus kewensis* (Aiton 1789) which was followed in 1810–1813 by a second edition produced by his son William Townsend Aiton (Aiton 1810–1813). In both cases, leading botanists of the day collaborated in preparing brief botanical descriptions of all species listed, 11,013 in total for the second edition (Smith 1870). Jonas Dryander filled this role for the first edition and part of the second while Robert Brown completed the latter (Britten 1912). It appears that, in most cases, the authors of other encyclopaedias and listings used Aiton's data although occasional conflicting dates appear in Curtis's *The botanical magazine*, Andrews's *The botanist's repository* and others. What means are available for checking the accuracy of recorded dates?

One possibility is if manuscript records and/or herbarium specimens exist for these plants. Nelson (1983) used this method and was able to show that four and probably five of the dates given in Aiton (1789) for plants introduced before 1788 were incorrect; moreover, one plant attributed to Banks in 1771, *Eucalyptus gummifera*, was not listed in *Hortus kewensis*. Another method of checking the earliest introductions is by considering the dates of return of the First Fleet ships which were the sole means of sending seeds to England. Yet a third involved knowledge of arrival dates in New South Wales of known collectors.

The first news from the colony was received in England on 25 March 1789 (Barton 1889) from the transport *Prince of Wales* and the storeship *Borrowdale*. Other ships returned in subsequent months and we may presume that some or all carried seeds and plant specimens. Hence the eighteen species listed in *Hortus kewensis* as being introduced in 1788 can only have been grown in 1789 and one for 1787, *Leptospermum flavescens*, is obviously an error.

Another mistake is found for three species of *Grevillea* supposedly introduced by Colonel Paterson via either Banks or Lee and Kennedy in 1791. As Paterson arrived in October 1791, he could not have sent the seeds before 26 November when the *Supply* sailed (Cumpston 1977). This vessel reached England at the end of April 1792 (Historical records of Australia 1971). A similar error occurs with *Notolaea longifolia*, claimed to have been sent to Lee and Kennedy by Paterson in 1790. Both *Oxylobium ilicifolium* (Burton via Lee and Kennedy in 1791) and *Tristaniopsis laurina* (Governor Phillip via Banks in 1798) are probably incorrect in some details as well. Burton reached Sydney Cove on 22 September 1791 on the *Gorgon* (Cobley 1980c) and sent away 60 tubs of plants when this ship sailed on 18 December. Seeds of *Oxylobium ilicifolium* may have been forwarded by someone else. The date 1798 for *Tristaniopsis laurina* should probably be 1789 as Phillip left New South Wales in December 1792 (Cobley 1980e). These examples serve to illustrate that many of the accepted dates are at best approximations; where I have detected such discrep-

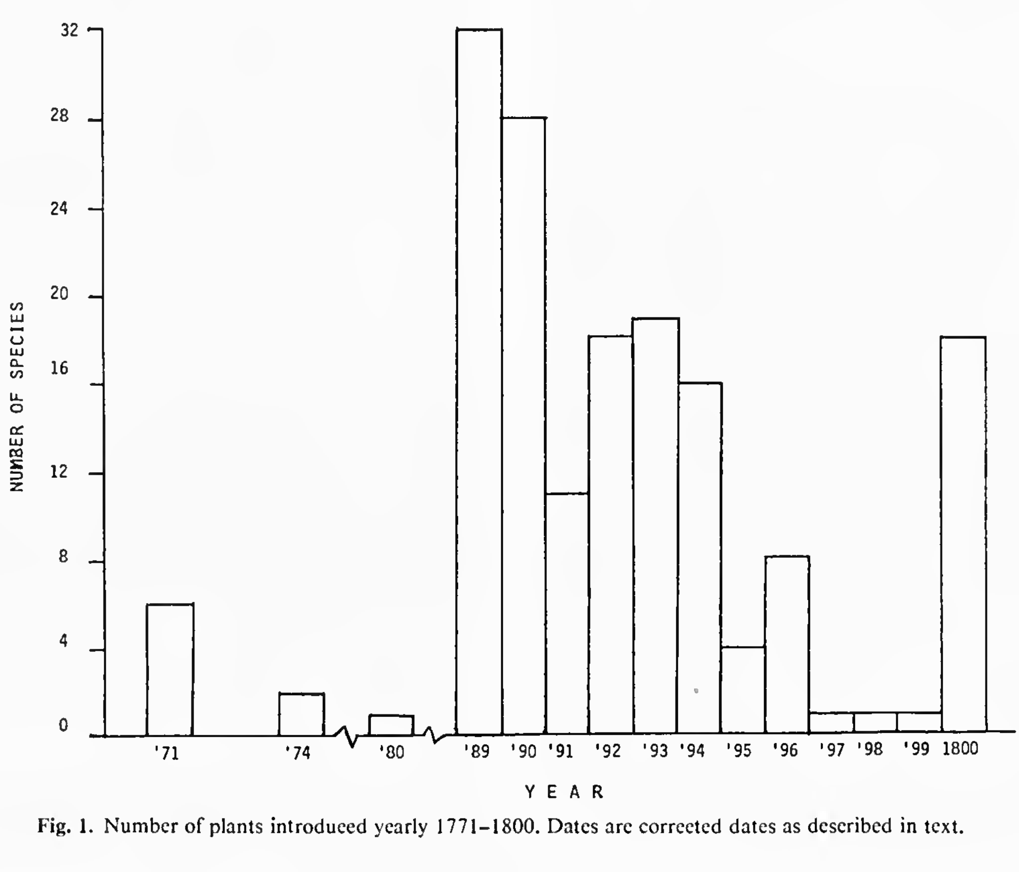

Fig. 1. Number of plants introduced yearly 1771–1800. Dates are corrected dates as described in text.

ancies in Appendix 1, I have indicated the more probable date of introduction in square brackets. The histogram of Figure 1 is based on these corrections.

Finally, in descriptions of plants in Curtis's *The botanical magazine* and Andrews's *Botanists repository*, occasional earlier dates and/or different introducers are given: for example, P. Miller of Chelsea in 1790 for *Crinum pedunculatum* instead of the usually accepted date of 1791 (*Bot. Mag.* pl. 1073, 1807). In such cases, I have added this information in round brackets.

Suppliers of seeds and living plants

The first seeds were brought to England by Banks and Solander in 1771 when they returned from Cook's first voyage and five plants were subsequently raised at Kew (Nelson 1983). These were *Eucalyptus gummifera*, *Allocasuarina torulosa*, *A. verticillata*, *Pouteria sericea* and *Cajanus reticulatus* (formerly *Atylosia reticulata*). A further three plants were introduced by 1780 — *Eucalyptus obliqua* and *Leptospermum lanigerum* from the second voyage and *Acacia verticillata* from the third. The latter three were collected at Adventure Bay on Tasmania's south east coast. According to Nelson, *Eucalyptus obliqua* was the first Australian plant sold to English gardeners, probably around 1774 after Thomas Furneaux brought back the seed. William Malcolm of Kensington had plants available and the Earl of Coventry was one of the first purchasers. The first Australian plants to be flowered in cultivation were the group of six sent to Banks from Kew for identification in 1778 (Nelson 1983).

After the arrival of the First Fleet in 1788, an extensive trade quickly developed in New Holland curiosities. Barely one month after settlement, the steward of a transport was flogged for buying an 'opposum' from a convict for a bottle of rum, the purchase of anything from convicts being strictly forbidden (Cobley 1980a). The collection of natural history specimens obviously had its dangers in these days! The Judge Advocate, David Collins subsequently complained of convicts 'every where straggling about, collecting animals and gum to sell to the people of the transports' (Collins, quoted in Gilbert 1962, p. 87). However, in later years, convicts with botanical knowledge were used to collect seeds and plants and some such as Thomas Watling produced many paintings of the flora and fauna (Whitley 1938). Nor was the trade confined to convicts. On an official level, Governor Phillip corresponded extensively with Joseph Banks and sent him seeds, dried plants, specimens of timber and clay as well as live and stuffed animals. Others who supplied Banks with seeds and specimens included the Colonial Chaplain, Reverend Mr Johnson (Cobley 1980a), Surgeons Dennis Considen and George Bass, and Major Ross of the Marines (Gilbert 1962). The tradition of serving governors supplying seeds and animals to Banks and other officials of the Home Government continued with Phillip's successors Major Grose (1793–1794), Captain William Paterson (1794–1795), Captain John Hunter (1795–1800) and later both Captains Phillip Gidley King (1800–1806) and William Bligh (1806–1808). Major Grose in fact also apparently collected for a Mr McKay, his letter of 2 April 1792 possibly being one of the first indications of officials supplying private individuals (Cobley 1980c).

Despite the lack of 'official' botanists and gardeners, there were some nineteen amateur naturalists among the officers and officials who came out with the First Fleet (Whitley 1938). Many of these were surgeons, e.g. White, Worgan, Considen, Harris and Bowes Smyth but they, like Marine Watkin Tench and Naval Lieutenant William Bradley, were captivated by the beauty and quaintness of the Australian bush (Gilbert 1962). They collected seeds and material which were either sold or sent back to Banks and others in England: John White supplied seeds, plant specimens and animals to Mr Wilson, A. B. Lambert and the renowned English botanist Dr J. E. Smith. Illustrations of these appeared in *A specimen of the botany of New Holland* (Smith 1793), as well as in White's own account (White 1962).

The first despatches and seeds from Phillip at Botany Bay reached England on 25 March 1789 (Barton 1889), aboard the *Prince of Wales*. While much of the material went to Banks and the Royal Botanic Gardens at Kew, seeds were also received by Lee and Kennedy who could thus claim to have had the first seeds from the new settlement. The first plants they offered for sale included *Banksia serrata*, *B. oblongifolia*, *Leptospermum laevigatum*, *Lambertia formosa* and *Melaleuca armillaris* (Willson 1961; Coates 1962). Thus far, it has not been possible to trace who supplied them with seeds.

While seeds, dried specimens and 'gum' were initially the main commercial forms of plant material sent, in later years living plants were sent over in tubs (usually half rum casks) and eventually Wardian cases. Around 1789, a plant of *Callistemon citrinus* was grown in England from a 'root sent over from Botany Bay' (*Bot. Mag.* t. 260) and in 1790, Phillip forwarded six tubs of plants to Banks via the *Neptune* which sailed on 23 August. What is intriguing, and perhaps evidence of an extensive clandestine trade in plants, was Phillip's note 'They are marked, to distinguish them from those the master of the ship has on board of his own' (Phillip to Banks 22 August, quoted in Cobley 1980b, p. 273). In December 1791 the *Gorgon* sailed for England carrying 60 tubs containing 221 plants for the King's Garden at Kew; seed also had been sowed in all the tubs (Cobley 1980c). Lieutenant Gardner, an officer on the *Gorgon* indicated that much material was also being sent to others: 'Green houses had been made on the Qr deck whilst in Port Jackson for the reception of plants which were now on board about a hundred tubs beside a room full on the main deck' (Cobley 1980c, p. 198). A young superintendent of convicts, David Burton, who had been appointed by Banks as collector (Gilbert 1962) was mainly responsible for this impressive collection. However, there is evidence that he also collected for Lee and Kennedy (Willson 1961; Coates 1969) and certainly he is credited with introducing through Lee and Kennedy *Mirbelia rubifolia* and *Oxylobium ilicifolium* around 1792 and two melaleucas, *M. decora* and *M. styphellioides* through Banks (Aiton 1810–1813). His untimely death in 1792, after a duck shooting accident, robbed the colony of one of its most promising amateur botanists.

The other major supplier of seeds during these years was an officer in the New South Wales Corps, Captain William Paterson who arrived on the *Admiral Barring-*

ton in October 1791 (Cobley 1980c) and was almost immediately transferred to Norfolk Island (Ellis 1961). In his nine days in Sydney, he collected seed of three grevilleas including *G. buxifolia* which was flowered for the first time at Lee and Kennedy's in 1795, as well as several other plants which were introduced through both Banks and Lee and Kennedy. He collected extensively on Norfolk Island (*Pandorea pandorana* came from there in 1793) and later Tasmania; *Hortus kewensis* credits him with around 15 introductions up to 1800. His botanical activities were instrumental in helping him realise his major ambition of fellowship of the Royal Society for which he was sponsored by Banks.

Conclusion

Thus, by many means, seeds and plants reached England after the settlement of Australia. The large number of plants indicate a degree of fascination with our flora, which is at first hard to understand given the difficulties the infant colony experienced in its first few years. There is little doubt that the dominating influence of Sir Joseph Banks on the English botanical scene was primarily responsible for the continuing interest in Australian plants. In addition, the role of nurserymen, some of whom sent collectors to Australia after 1800, was also important in providing an economic incentive for plant and seed collection. However, to many of the collectors of seeds and plants, the Australian bush was a fascinating place. I believe the beauty and uniqueness of Australian plants contributed at least as much to their popularity in English gardens and glasshouses as did their availability due to commercial demand or the desire for personal and political favours.

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Appendix

Australian plants cultivated in England: 1771–1800

Taxon	Introduced Date	By	Discoverer/seed collector	First flowered	Illustrated
Abroma fastuosa R. Br.	[1771] 1800				Salisb., *Par. lond.* pl. 102 (1808).
Acacia binervia (Wendl.) Macbride	1790				Willd., *Hort. berol.* pl. 101 (1812); *Bot. Mag.* pl. 3174 (1832).
A. brownei (Poir.) Steud.	1796	Banks	Paterson		G. Lodd., *Bot. Cab.* pl. 1333 (1828).
A. decurrens Willd.	1790	Banks			Vent., *Jard. Malmaison* pl. 61 (1804); *Bot. Reg.* pl. 371 (1819).
A. falcata Willd.	1790	Banks			H. L. Wendl. *Comm. Acac. aphyll.* pl. 14 (1820); G. Lodd., *Bot. Cab.* pl. 1115 (1826).
A. floribunda (Vent.) Willd.	1796	Banks			Vent., *Choix pl.* pl. 13 (1803–04).
A. hispidula (Sm.) Willd.	1794	Banks			Sm., *Spec. bot. New Holl.* pl. 16 (1795): G. Lodd., *Bot. Cab.* pl. 823, 836 (1824).
A. linifolia (Vent.) Willd.	1790	Banks			Vent., *Descr. pl. nouv.* pl. 2 (1800); Andr., *Bot. repos.* pl. 394 (1804); *Bot. Mag.* pl. 2168 (1820).
A. longifolia (Andr.) Willd.	1792	John Ord		J. White 1801	Andr., *Bot. repos.* pl. 207 (1802); Vent., *Jard. Malmaison* pl. 107 (1805); *Bot. Mag.* pl. 1827, 2166 (1816, 1820); *Bot. Reg.* pl. 362 (1819); G. Lodd., *Bot. Cab.* pl. 678 (1822).
A. myrtifolia (Sm.) Willd.	1789	Thos. Hoy		?1790	*Bot. Mag.* pl. 302 (1795); Sm., *Spec. bot. New Holl.* pl. 15 (1795); G. Lodd., *Bot. Cab.* pl. 722 (1823); Sweet, *Fl. australas.* pl. 49 (1828).
A. pubescens (Vent.) R. Br.	1790	Banks		Lee & Kennedy ?1810	Vent., *Jard. Malmaison* pl. 21 (1803); *Bot. Mag.* pl. 1263 (1810).
A. pulchella var. *glaberrima* Meisn.	1800				*Bot. Mag.* pl. 4588 (1851).
A. stricta (Andr.) Willd.	1790	Banks			Andr., *Bot. repos.* pl. 53 (1799); *Bot Mag.* pl. 1121 (1808).
A. sauveolens (Sm.) Willd.	1790	Thos. Hoy			Salisb., *Prod. stirp. Chap. Allerton* pl. 325 (1796); G. Lodd., *Bot. Cab.* pl. 730 (1823).
A. terminalis (Salisb.) Macbride	[1789] 1788	Banks		W. H. Irby 1801	Andr., *Bot. repos.* pl. 235 (1802); *Bot. Mag.* pl. 1750 (1815); G. Lodd., *Bot. Cab.* pl. 601 (1822).
A. ulicifolia (Salisb.) Court	1790	Banks			Vent., *Jard. Malmaison* pl. 64 (1804); G. Lodd., *Bot. Cab.* pl. 398 (1820).
A. verticillata (L'Her.) Willd.	1780	Banks	D. Nelson & W. Anderson	Messrs. Malcolm ?1790	*Bot. Mag.* pl. 110 (1790); Vent., *Jard. Malmaison* pl. 63 (1804); *Bot. Reg.* pl. 67 (1846); G. Lodd., *Bot. Cab.* pl. 535 (1821).
Acmena smithii (Poir.) Merrill & Perry	1790	Banks			Vent., *Jard. Malmaison* pl. 75 (1804); *Bot. Mag.* pl. 1872 (1816).
Allocasuarina torulosa (Ait.) L. Johnson	1771	Banks	Banks & Solander	Kew 1778	———
A. verticillata (Lam.) L. Johnson	1771	Banks	Banks & Solander	Kew	Andr., *Bot. repos.* pl. 346 (1804).
Angophora hispida (Sm.) Blaxell	1789 1787	Lee & Kennedy W. Pitcairn		Hibbert July 1798	Andr., *Bot. repos.* pl. 281 (1803); Vent., *Jard. Malmaison* pl. 5 (1803); Sm., *Exot. bot.* pl. 42 (1805); *Bot. Mag.* pl. 1960 (1818).
Aotus ericoides (Vent.) G. Don	1790	Banks		1801	Vent., *Jard. Malmaison* pl. 35 (1804); Labill., *Nov. Holl.* pl. 104 (1805); *Bot. Mag.* pl. 949 (1806); G. Lodd., *Bot Cab.* pl. 1353 (1828).
Arthropodium milleflorum (DC.) Macbride	1800	Banks	George Caley		Andr., *Bot. repos.* pl. 395 (1804); *Bot. Mag.* pl. 1421 (1811); *Bot. Reg.* pl. 866 (1825).
Banksia attenuata R. Br.	1794	Banks	Menzies		———

B. ericifolia L.f.	[1789] 1788	Thos. Watson		E. J. Woodford 1802	Andr., *Bot. repos.* pl. 156 (1801); *Bot. Mag.* pl. 738 (1804).
B. grandis Willd.	1794	Banks	Menzies		———
B. integrifolia L.f.	[1789] 1788	Thos. Watson			Cav., *Icon.* pl. 546 (1800); *Bot. Mag.* pl. 2770 (1827).
B. oblongifolia Cav.	[1789] 1788	Lee & Kennedy			G. Lodd., *Bot. Cab.* pl. 241 (1819).
B. praemorsa Andr.	1794	Banks	Menzies	Clapham 1802	Andr., *Bot. repos.* pl. 258 (1802); Sweet, *Fl. australas.* pl. 14 (1827); *Bot. Mag.* pl. 2803 (1828).
B. serrata L.f.	[1789] 1788	Lee & Kennedy		J. Ord 1797	*Bot. Reg.* pl. 1316 (1830); Andr., *Bot. repos.* pl. 82 (1800).
B. serratifolia Salisb.	[1789] 1788				*Bot. Reg.* pl. 688 (1823); *Bot. Mag.* pl. 2671 (1826).
B. spinulosa Sm. var. *spinulosa*	[1789] 1788	Banks			Sm., *Spec. bot. New Holl.* pl. 4 (1793); Andr., *Bot. repos.* pl. 457 (1807).
B. spinulosa Sm. var. *collina* (R. Br.) A. S. George	1800	Banks	?Caley		*Bot. Reg.* pl. 1363 (1830–31); *Bot. Mag.* pl. 3060 (1831).
B. verticillata R. Br.	1794	Banks	Menzies		Hook., *Exot. fl.* pl. 96 (1824).
Bauera rubioides Andr.	1793	Marchioness of Rockingham		Grimwood & Wykes 1804	Andr., *Bot. repos.* pl. 198 (1801); *Bot. Mag.* pl. 715 (1804); Vent., *Jard. Malmaison* pl. 96 (1805).
Billardiera scandens Sm.	1790	Banks		1802	Sm., *Spec. bot. New Holl.* pl. 1 (1793); *Bot. Mag.* pl. 801, 1313 (1804, 1810); Salisb., *Parad. lond.* pl. 48 (1806–07); Sweet, *Fl. australas.* pl. 54 (1827–28).
Boronia pinnata Sm.	1794	Lee & Kennedy	?White	Lee & Kennedy 1795	Sm., *Tracts nat. hist.* pl. 290 (1798); Andr., *Bot. repos.* pl. 58 (1799); Vent., *Jard. Malmaison* pl. 38 (1804); *Bot. Mag.* pl. 1763 (1815); G. Lodd., *Bot. Cab.* pl. 473 (1821).
Bossiaea heterophylla Vent.	1792	Lee & Kennedy		Lee & Kennedy 1801	Vent., *Descr. pl. nouv.* pl. 7 (1800); Andr., *Bot. repos.* pl. 205, 276 (1802, 1803); *Bot. Mag.* pl. 1144 (1808); G. Lodd., *Bot. Cab.* pl. 271 (1819).
B. scolopendria (Andr.) Sm.	1792	Lee & Kennedy		1799	Andr., *Bot. repos.* pl. 191 (1801); Vent., *Jard. Malmaison* pl. 55 (1804); *Bot. Mag.* pl. 1235 (1809); G. Lodd., *Bot. Cab.* pl. 1747 (1831).
Bursaria spinosa Cav.	1793	Marchioness of Rockingham		?Sept. 1801	Cav., *Icon.* pl. 350 (1797); Andr., *Bot. repos.* pl. 314 (1803); *Bot. Mag.* pl. 1767 (1815).
Cajanus reticulatus (Dryander) F. Muell.	1771	Banks	Banks & Solander		———
Callicoma serratifolia Andr.	1793			?Mr. Barr	Andr., *Bot. repos.* pl. 566 (1809); *Bot. Mag.* pl. 1811 (1816); G. Lodd., *Bot. Cab.* pl. 1167 (1827).
Callistemon citrinus (Curtis) Skeels	[1789] 1788	Banks		Lord Cremorne 1793	*Bot. Mag.* pl. 260 (1794).
C. linearis (Wendl. & Schrad.) DC.	[1789] 1788	Banks			Schrad., *Sert. hannov.* pl. 11 (1796).
C. lophanthus Sweet	1800				Sweet, *Fl. australas.* pl. 29 (1827); G. Lodd., *Bot. Cab.* pl. 1302 (1828).
C. salignus (Sm.) Sweet	[1789] 1788				Vent., *Descr. pl. nouv.* pl. 70 (1802); *Bot. Mag.* pl. 1821 (1816).
C. viminalis (Solander ex Gaertn.) G. Don ex Loudon	?1800				*Bot. Reg.*, pl. 393 (1819).
Calomeria amaranthoides Vent.	1800	Banks		Lady Hume 1804	Sm., *Exotic bot.* pl. 1 (1804); Vent., *Jard. Malmaison* pl. 73 (1804).
Carpobrotus glaucescens (Haw.)	1791	Banks			———
Cissus antarctica Vent.	1790	Banks			Vent., *Choix pl.* pl. 21 (1803–04); *Bot. Mag.* pl. 2488 (1824).
Clerodendron tomentosum R. Br.	1794	Banks			Andr., *Bot. repos.* pl. 607 (1810); *Bot. Mag.* pl. 1518 (1813).

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Correa alba Andr.	1793	Banks		J. Vere 1789	Andr., *Bot. repos.* pl. 18 (1798); Vent., *Jard. Malmaison* pl. 13 (1803); Salisb., *Parad. lond.* pl. 100 (1808); *Bot. Reg.* pl. 515 (1820–21).
C. reflexa (Labill.) Vent.	1800	Hibbert		Marquis of Blandford 1804	Sm., *Exot. bot.* pl. 72 (1805–08); Andr., *Bot. repos.* 436, 653 (1806, 1812); *Bot. Mag.* pl. 1746, 1901 (1815, 1817); *Bot. Reg.* pl. 326 (1818–19).
Crinum pedunculatum R. Br.	(?1790 — P. Miller, *Bot. Mag.* pl. 1073) 1791				*Bot. Mag.* pl. 1073, 2121, 2133, 2355 (1807, 1820, 1822); *Bot. Reg. pl.* 52, 426 (1815–16, 1819–20).
Crowea saligna Andr.	1790	Lee & Kennedy		1796	Andr., *Bot. repos.* pl. 79 (1800); Vent., *Jard. Malmaison* pl. 7 (1803); *Bot. Mag.* pl. 989 (1807).
Daviesia ulicifolia Andr.	1792	Lee & Kennedy		Hibbert ?1802	Andr., *Bot. repos.* pl. 304 (1803); G. Lodd., *Bot. Cab.* pl. 44, 1552 (1817, 1830).
Dianella caerulea Sims	?1789	Banks		?R. Cuff ?1793	*Bot. Mag.* pl. 505 (1801); *Bot. Reg.* pl. 1120 (1827–28).
Dillwynia floribuna Sm.	1794	Alexander Murray			Sm., *Exotic bot.* pl. 26 (1804–05); *Bot. Mag.* pl. 1544, 1545 (1813); G. Lodd., *Bot. Cab.* pl. 305 (1819).
D. glaberrima Sm.	1800	Banks		Loddiges	Labill., *Nov. Holl.* pl. 139 (1805); *Bot. Mag.* pl. 944 (1806); G. Lodd., *Bot. Cab.* pl. 582 (1822).
D. parvifolia R. Br.	1800				*Bot. Mag.* pl. 1527 (1813); G. Lodd., *Bot. Cab.* pl. 559 (1821).
D. retorta (Wendl.) Druce	1794	Hughes of Stockdale			Wendl. *Hort. herrenhus.* pl. 9 (1799); Sm., *Exot. bot.* pl. 25 (1804–05).
Dodonaea triquetra Wendl.	1790	Banks			Andr., *Bot. repos.* pl. 230 (1802).
Doryanthes excelsa Corr.	1800	Captain Waterhouse		?Charles Lang 1814	*Bot. Mag.* pl. 1685 (1814).
Elaeodendron australe Vent.	1796	Banks			Vent., *Jard. Malmaison* pl. 17 (1803).
Eucalyptus gummifera (Gaert.) Hochr.	1771	Banks	Banks & Solander	Kew 1778	Cav., *Icon.* pl. 340 (1797).
E. marginata Donn ex Sm.	1794	Banks	Menzies		———
E. obliqua L'Herit.	1774	Tobias Furneaux	Tobias Furneaux	Kew 1778	Salisb., *Parad. lond.* pl. 15 (1805).
E. piperita Sm.	[1789] 1788	Banks			J. White, R.M., *J. Voy. N.S.W.* pl. 23 (1790) p. 226.
E. resinifera Sm.	[1789] 1788	Banks		1804	Andr., *Bot. repos.* pl. 400 (1804); Sm., *Exot. bot.* pl. 84 (1805–08).
E. robusta Sm.	1794	Banks			Sm., *Spec. bot. New Holl.* pl. 13 (1795).
Eustrephus latifolius R. Br.	1800	Whitley & Brames		Whitley & Brames	*Bot. Mag.* pl. 1245 (1809).
Ficus rubiginosa Desf. ex Vent.	1789	Banks			Vent., *Jard. Malmaison* pl. 114 (1805); *Bot. Mag.* pl. 2939 (1829).
Goodenia ovata Sm.	1793	Lee & Kennedy	Paterson	Lee & Kennedy 1798	Andr., *Bot. repos.* pl. 68 (1799); Vent., *Descr. pl. nouv.* pl. 3 (1800); Cav., *Icon.* pl. 506 (1800).
Goodia lotifolia Salisb.	1793	Rear Admiral Bligh	Nelson	1798	Salisb., *Parad. lond.* pl. 41 (1805–06); *Bot. Mag.* pl. 958 (1806); G. Lodd., *Bot. Cab.*, pl. 696 (1823).
Grevillea buxifolia (Sm.) R. Br.	[1792] 1791	Lee & Kennedy	Paterson	Lee & Kennedy 1795	Sm., *Spec. bot. New Holl.* pl. 10 (1794); Andr., *Bot. repos.* pl. 218 (1802); *Bot. Reg.* pl. 433 (1820); G. Lodd., *Bot. Cab.* pl. 1562 (1830).
G. linearifolia (Cav.) Druce	[1792] 1791	Banks	Paterson	Lee & Kennedy 1800	Andr., *Bot. repos.* pl. 272 (1803); G. Lodd., *Bot. Cab.* pl. 50 (1817); *Bot. Mag.* pl. 2661 (1826).
G. sericea (Sm.) R. Br.	[1792] 1791	Lee & Kennedy	Paterson	Loddiges 1805	Andr., *Bot. repos.* pl. 100 (1800); *Bot. Mag.* pl. 862, 3798 (1805, 1840); G. Lodd., *Bot. Cab.* pl. 880, 1737 (1824, 1831).

Hakea cineria R. Br.	1800				———
H. dactyloides (Gaert.) Cav.	1790				Cav., *Icon.* pl. 535 (1800); Vent., *Jard. Malmaison* pl. 110 (1805); G. Lodd., *Bot. Cab.* pl. 1501 (1829); *Bot. Mag.* pl. 3760 (1839).
H. gibbosa Cav.	1790	Banks			Cav., *Icon.* pl. 534 (1800).
H. oleifolia R. Br.	1794	Banks	Menzies		———
H. sericea Sehrad. & Wendl.	1790	Banks			Vent., *Jard. Malmaison* pl. 111 (1805).
H. salicifolia (Vent.) B. L. Burtt	1791	Lee & Kennedy			Andr., *Bot. repos.* pl. 215 (1802); Sweet, *Fl. australas.* pl. 27 (1827–28).
H. teretifolia (Salisb.) J. Britten	1796	Cult. by Sir T. Gage	Paterson		G. Lodd., *Bot. Cab.* pl. 353 (1820).
Hardenbergia violacea (Sehneev.) Stearn.	1790	Banks		John Ord 1794	*Bot. Mag.* pl. 263 (1794); Vent., *Jard. Malmaison* pl. 106 (1805); Maund, *Bot. Gard.* pl. 84 (1832).
Helichrysum bracteatum (Vent.) Andr.	1799	?Banks			Vent., *Jard. Malmaison* pl. 2 (1803); Andr., *Bot. repos.* pl. 375 (1804).
Hibbertia scandens (Willd.) Gilg.	1790	Banks			*Bot. Mag.* pl. 449 (1799); Andr., *Bot. repos.* pl. 126 (1800); Vent., *Choix pl.* pl. 11 (1803).
Hovea linearis (Smith) R. Br.	1796	Hibbert			G. Lodd., *Bot. Cab.* pl. 1222, 1336 (1827, 1828).
Indigofera australis Willd.	1790	Banks			Vent., *Jard. Malmaison* pl. 45 (1804); G. Lodd., *Bot. Cab.* 149 (1818); *Bot. Reg.* pl. 386 (1819).
Isopogon anemonifolius (Salisb.) Knight	1791	Banks		Napier 1803	Andr., *Bot. repos.* pl. 332 (1803); *Bot. mag.* pl. 697 (1803).
I. anethifolius (Salisb.) Knight	1796	Cult. by Salisbury			Salisb., *Prod. stirp. Chap. Allerton* pl. 48 (1796); Cav., *Icon.* pl. 549 (1800).
Kennedia prostratá R. Br.	1790				*Bot. Mag.* pl. 270 (1794).
K. rubicunda (Sehneev.) Vent.	[1789] 1788	Banks			*Bot. Mag.* pl. 268 (1794); Vent., *Jard. Malmaison* pl. 104 (1805).
Kunzea ambigua (Sm.) Druee	1791	?Banks			Vent., *Jard. Malmaison* pl. 46 (1804); Sm., *Exot. bot.* pl. 59 (1805); G. Lodd., *Bot. Cab.* pl. 1988 (1833).
Lambertia formosa Sm.	[1789] 1788	Lee & Kennedy		July 1798	Andr., *Bot. repos.* pl. 69 (1799); Cav., *Icon.* pl. 547 (1800); *Bot. Reg.* pl. 528 (1821).
Lasiopetalum ferrugineum Sm.	1791	Lee & Kennedy			Andr., *Bot. repos.* pl. 208 (1802); Vent., *Jard. Malmaison* pl. 59 (1804); *Bot. Mag.* pl. 1766 (1815).
Leptospermum arachnoides Gaertn.	1795				Vent, *Jard. Malmaison* pl. 88 (1805); G. Lodd., *Bot. Cab.* pl. 791 (1823).
L. attenuatum Sm.	1795	Banks			———
L. flavescens Sm.	[1789] 1787	Banks			G. Lodd., *Bot. Cab.* pl. 514 (1821); *Bot. Mag.* pl. 2695 (1826); Sweet, *Fl. australas.* pl. 36 (1827–28).
L. juniperinum Sm.	1790	John Fairbairn			Vent., *Jard. Malmaison* pl. 89 (1805).
L. laevigatum (Soland. ex Gaertn.) F. Muell.	[1789] 1788	Lee & Kennedy		May 1809 Gardens of Dublin Soe.	*Bot. Mag.* pl. 1304 (1810).
L. lanigerum (Ait.) Sm.	1774	Tobias Furneaux		Kew 1778	*Bot. Mag.* pl. 1810 (1816); G. Lodd., *Bot. Cab.* pl. 701, ?1192 (1823, 1827).
L. parvifolium Sm.	1789	Banks			
Leucopogon lanceolatus (Sm.) R. Br.	1790	Lee & Kennedy		R. Cuff 1802	? Andr., *Bot. repos.* pl. 287 (1803); Sweet, *Fl. australas.* pl. 47 (1827–28). *Bot. Mag.* pl. 3162 (1832).
Logania albiflora (Andr.) Druee	1797				Andr., *Bot. repos.* pl. 520 (1808).
Lomandra longifolia Labill.	1791 & 1796				Labill., *Nov. Holl. pl.* pl. 19 (1805); G. Lodd., *Bot. Cab.* pl. 798 (1823); *Bot. Reg.* pl. 1839 (1836).
Lomatia silaifolia (Sm.) R. Br.	1792	Banks		Imported plant 1793	Sm, *Spec. bot. New Holl.* pl. 8 (1793); Cav., *Icon.* pl. 384 (1798); *Bot. Mag.* pl. 1272 (1810).
Macrozamia spiralis Miq.	1796	Salisbury			———
Melaleuca armillaris (Soland. ex Gaertn.) Sm.	[1789] 1788	Lee & Kennedy		Marquis of Blandford 1801	Andr., *Bot repos.* pl. 175 (1801); Vent., *Jard. Malmaison* pl. 76 (1804).
M. decora (Salisb.) Britten	1793	Banks	Burton		Salisb., *Prod. stirp. Chap. Allerton* pl. 352 (1796); Sm., *Exot. bot.* pl. 55 (1805).
M. diosmifolia Andr.	1794	Banks	Menzies		Andr., *Bot. repos.* pl. 476 (1807).

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M. ericifolia Sm.	[1789] 1788	Banks	White		Sm., *Exot. bot.* pl. 34 (1805).
M. hypericifolia Sm.	1792	Cult. by Messrs. Malcolm	Admiral Phillip	Sept. 1799	Vent., *Descr. pl. nouv.* pl. 10 (1800); Andr., *Bot. repos.* pl. 200 (1802).
M. linariifolia Sm.	1793	Banks	Paterson		Sm., *Exot. bot.* pl. 56 (1805).
M. nodosa Sm.	1790	Lady de Clifford	?Banks		Sm., *Exot. bot.* pl. 35 (1805); Vent., *Jard. Malmaison* pl. 112 (1805).
M. quinquinervia (Cav.) S. T. Blake	1798				Cav., *Icon.* pl. 333 (1797).
M. squarrosa Donn ex Sm.	[1780] 1794	Banks	David Nelson		Vent., *Jard. Malmaison* pl. 47 (1804); *Bot. Mag.* pl. 1935 (1817); G. Lodd., *Bot. Cab.* pl. 1130 (1826).
M. styphelioides Sm.	1793	Banks	Burton		———
M. thymifolia Sm.	1792	Fairbairn	?Banks	Robinson Aug. 1794	Andr., *Bot. repos.* pl. 278 (1803); Sm., *Exot. bot.* pl. 36 (1805); *Bot. Mag.* pl. 1868 (1816); G. Lodd., *Bot. Cab.* pl. 439 (1820).
Mirbelia rubiifolia (Andr.) G. Don	1792	Lee & Kennedy	Burton	1794	Andr., *Bot. repos.* pl. 351 (1804); Vent., *Jard. Malmaison* pl. 119 (1805); *Bot. Mag.* pl. 1211 (1809); G. Lodd., *Bot. Cab.* pl. 1371 (1828).
Myoporum debile R. Br.	1793	Lee & Kennedy	Paterson	1801	Andr., *Bot. repos.* pl. 212 (1802); *Bot. Mag.* pl. 1830 (1816).
M. insulare R. Br.	1789	Banks			Andr., *Bot. repos.* pl. 283 (1803).
Nicotiana suaveolens Lehm.	1800	Banks	Paterson	Kew 1802	*Bot. Mag.* pl. 673 (1803); Vent., *Jard. Malmaison* pl. 10 (1803).
Notolaea longifolia Vent.	[1792] 1790	Lee & Kennedy	?Paterson	1803	Andr., *Bot. repos.* pl. 316 (1803); Vent., *Choix pl.* pl. 25 (1804).
Olearia tomentosa (Wendl.) DC.	1793	Lee & Kennedy			Andr., *Bot. repos.* pl. 61 (1799).
Opercularia aspera Gaertn.	1790	Banks			———
O. hispida Spreng.	1793	?Curtis			*Trans. Linn. Soc. London* 3: pl. 5 (1797).
Oxylobium ilicifolium (Andr.) Domin	[1792] 1791	Lee & Kennedy	Burton	Hibbert June 1801	Andr., *Bot. repos.* pl. 320 (1803); *Bot. Mag.* pl. 1477 (1812); *Bot Reg.* pl. 1333 (1830).
Pandorea pandorana (Andr.) Steenis	1793	Lee & Kennedy	Paterson	Loddiges 1805	Andr., *Bot. repos.* pl. 86 (1800); Vent., *Jard. Malmaison* pl. 43 (1804); *Bot Mag.* pl. 865 (1805).
Pelargonium australe Willd.	1792	Messrs. Grimmwade & Wykes			———
P. inodorum Willd.	1796				Willd., *Hort. berol.* pl. 34 (1804); Sweet, *Geraniaceae* pl. 56 (1820–22).
Persoonia hirsuta Pers.	1800				G. Lodd., *Bot. Cab.* pl. 327 (1820).
P. lanceolata Andr.	1791	J. Willson		Aug. 1796	Andr., *Bot. repos.* pl. 74 (1799).
P. levis (Cav.) Domin	1795	Lee & Kennedy	Paterson	Oct. 1802	Cav., *Icon.* pl. 389 (1798); Andr., *Bot. repos.* pl. 280 (1803).
P. linearis Andr.	1794	Benjamin Robertson		J. Robertson 1796	Andr., *Bot. repos.* pl. 77 (1799); *Bot. Mag.* pl. 760 (1804); Vent., *Jard. Malmaison* pl. 32 (1804).
Petrophile pulchella (Schrod.) R. Br.	1790	Banks		Napier & Chandler 1804	Cav., *Icon.* pl. 550 (1800); *Bot. Mag.* pl. 796 (1804).
Pimelea linifolia Sm.	1793	Banks		Lord Lewisham 1794	Sm., *Spec. bot. New Holl.* pl. 11 (1794); *Bot Mag.* pl. 891 (1805).
P. ? rosea R. Br.	1800				*Bot. Mag.* pl. 1458, 3721 (1812, 1839); G. Lodd., *Bot. Cab.* pl. 88 (1818).
Pittosporum revolutum Dryander	1795	Banks			*Bot. Reg.* 186 (1817); G. Lodd., *Bot. Cab.* pl. 506 (1821).
P. undulatum Vent.	1789	Banks		Colvilles	Vent., *Descr. pl. nouv.* pl. 76 (1802); Andr., *Bot. repos.* pl. 383 (1804); *Bot. Reg.* pl. 16 (1815).

Platylobium formosum Sm.	1790 & 1792	Banks		1798	Sm., *Spec. bot. New Holl.* pl. 6 (1793); *Bot. Mag.* pl. 469, 1520 (1800, 1813); Vent., *Jard. Malmaison* pl. 31 (1804); G. Lodd., *Bot. Cab.* pl. 1241 (1827); *Paxton's Mag. Bot.* pl. 195 (1846).
Pouteria sericea (Dryander) Baehni.	1771	Banks	Banks & Solander	Kew 1778	———
Psilotum nudum (L.) Beauv.	1793	Banks			Hook., *Gen. fil.* pl. 87 (1842).
Pultenea daphnoides Wendl.	1792	Banks		Hibbert 1796	Wendl., *Hort. herrenhus.* pl. 17 (1800); Andr., *Bot. repos.* pl. 98 (1800); *Bot. Mag.* pl. 1394 (1811); G. Lodd., *Bot. Cab.* pl. 1143 (1826).
P. linophylla Sehrad.	1789	Banks			Sehrad., *Sert. hannov.* pl. 18 (1797).
P. paleacea Willd.	1789				G. Lodd., *Bot. Cab.* pl. 291 (1819).
P. retusa Sm.	1789	Banks			*Bot. Mag.* pl. 2081 (1819); *Bot. Reg.* pl. 378 (1819).
P. stipularis Sm.	1792	Benjamin Robertson		Murray 1794	Sm., *Spec. bot. New Holl.* pl. 12 (1794); *Bot. Mag.* pl. 475 (1800).
P. villosa Willd.	1790	Greenwood & Barritt		Lee & Kennedy 1801	Andr., *Bot. repos.* pl. 309 (1803); *Bot Mag.* pl. 967 (1806).
Scaevola albida (Sm.) Druee	[1793]	Banks	Watkin Teneh	1795	*Bot. Mag.* pl. 287 (1795); Cav., *Icon.* pl. 509 (1800).
	1790	Curtis			
S. calendulaceae (Andr.) Druee	1793	Lee & Kennedy	Paterson	1795	Andr., *Bot. repos.* pl. 22 (1798).
Smilax australis R. Br.	1791	Banks			———
Sowerbaea juncea Sm.	1792	Lee & Kennedy		May 1798	Andr., *Bot. repos.* pl. 81 (1800); *Bot. Mag.* pl. 1104 (1808).
Sprengelia incarnata R. Br.	1793	Lee & Kennedy		Lee & Kennedy; Hibbert 1795	Andr., *Bot. repos.* pl. 2 (1797); Sm., *Tracts nat. hist.* pl. 2 (1798); *Bot. Mag.* pl. 1719 (1815); G. Lodd., *Bot. Cab.* pl. 262 (1819).
Styphelia tubiflora Andr.	1793	Hibbert		Hibbert 1799	Andr., *Bot. repos.* pl. 72 (1799); *Bot. Mag.* pl. 1297 (1810); G. Lodd., *Bot. Cab.* pl. 426 (1820).
S. viridis Andr.	1791	Lee & Kennedy		Hibbert Apr. 1803	Andr., *Bot. repos.* pl. 312 (1803); Sweet, *Fl. australas.* pl. 50 (1827–28).
Swainsona galegifolia (Andr.) R. Br. ex Aiton	1800	Lee & Kennedy	Paterson	Colville & Sons, Aug. 1803	Andr., *Bot. repos.* pl. 319 (1803); *Bot. Mag.* pl. 792 (1804); Salisb., *Parad. lond.* pl. 28 (1805–06); G. Lodd., *Bot. Cab.* pl. 1642 (1831).
Telopea speciosissima R. Br.	1789	Dowager Lady de Clifford (imported plant)		E. J. Woodford May 1807	Sm., *Spec. bot. New Holl.* pl. 7 (1793); *Bot. Mag.* pl. 1128 (1808).
Tristaniopsis laurina (Sm.) Peter G. Wilson & Waterhouse	[1789] 1798	Banks	Admiral Phillip		———
Viminaria juncea (Sehrad. ex Wendl.) Hoffsgg.	1789	Banks		July 1794	Sehrad., *Sert. hannov.* pl. 3 (1795); Vent., *Choix. pl.* pl. 6 (1803); Sm., *Exot. bot.* pl. 27 (1805); *Bot. Mag.* pl. 1109 (1809).
Wahlenbergia gracilis (Forst. f.) Sehrad.	1794	Curtis		Lady Hume	*Bot. Mag.* pl. 691 (1803); Sm., *Exot. bot.* pl. 45 (1805).
Westringia fruticosa (Willd.)	1791	Lee & Kennedy			Andr., *Bot. repos.* pl. 14 (1798); Sm., *Tracts nat. hist.* pl. 3 (1798).
Xylomelum pyriforme (Gaertn.) Knight	1789	Banks			Cav., *Icon.* pl. 536 (1800).

'. . . and flowers for our amusement': the early collecting and cultivation of Australian plants in Europe and the problems encountered by today's taxonomists

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Abstract

Australian plants have been grown in Europe since 1772 when seedlings were raised at the Royal Gardens, Kew. The foundation of the colony of New South Wales provoked a fashion among gardeners for the cultivation of Australian species, and seeds and living plants were regularly sent from the colony. Private gardeners could soon purchase a substantial selection of Australian plants from nurseries. French collectors also played a small part in the introduction of plants from Australia.

These fashionable flowers were difficult to grow, but considerable success was achieved in British gardens and the illustrated periodicals of the period 1787–1840 regularly featured examples. However, as hardier, colourful exotics were introduced to England from other regions, and as refined systems were devised for transporting living plants, the fashion for the demanding Australian plants waned rapidly, and after 1840 they became largely the amusement of botanical gardens.

Australian endemics were occasionally described and named from cultivated plants between 1788 and 1815. The difficulties of locating type specimens and bibliographic problems are noted in this review.

> 'Some see no beauty in our trees without shade, our flowers without perfume, our birds who cannot fly and our beasts that have not yet learned to walk on all fours; But the dweller in the wilderness becomes familiar with the beauty of loneliness . . .'[1]

Those lines by Marcus Clarke, written in 1876, mark the beginning of an indigenous appreciation of the Australian bush (Searle 1973). But a century earlier the beauty of the shade-denying trees and the scentless flowers had so impressed a '. . . swarm of modern tourists, yclept, or Botanists or Florists'[2] that Stingray Bay became Botany Bay (cf. Stearn 1968, 1969, 1974) and the romance between Britain and New Holland began. Within two decades, Botany Bay was to be transmogrified from a paradise of flowers into a hell (White 1790), becoming nothing short of terrifying particularly for the lower classes in Britain and Ireland. But James Cook's signal tribute to botany was not entirely tarnished by the miscreant cargoes that were '. . . bound for Botany Bay'[3]; in certain circles its name still evoked beauty; its name still retained the excitement of flora-drunken tourists. So a century before Marcus Clarke's bush-dweller learned to appreciate the '. . . hieroglyphs of haggard gum-trees'[1], there were people, gardeners especially, who admired and even lusted after the non-descript productions of this antipodal prison.

The lure of the plants of New Holland was such that before the First Fleet sailed, one enterprising nursery proprietor, James Lee, printed a set of instructions to ensure that any seeds, dispatched on the returning vessels of the First Fleet, had a fair chance of reaching London alive (Willson 1961). At first a mere trickle of species was transplanted to Europe (e.g. Nelson 1983) but by the 1820s that trickle was a steady, profitable stream. Yet soon afterwards it was insufficient and lack-lustre and another nurseryman, Joseph Knight, is said to have paid the huge sum of £1,500 for seeds and plants collected by William Baxter (Coats 1969, Gorer 1978, Willson 1982).

European horticulturists' fascination for Australian plants reached a peak in the 1830s, only diminishing when other botanical paradises were explored, revealing exquisite new flowers and thus allowing eager gardeners to choose novelties that either were not so culturally pernickety (such as rhododendrons) or, contrariwise, were even more demanding of horticultural technology (tropical water-lilies and orchids) (for accounts of plant introductions see especially Coats 1969, Gorer 1978). In all, Australian plants held sway in fashionable European gardens for perhaps just forty years, from about 1795 to 1835.

Pre-1788 introductions

The first indubitable record of the seeds of Australian native plants reaching Europe is contained in the reports of the expedition of Willem de Vlamingh (Schilder 1985; Nelson 1984) which returned to Holland in 1698 — along with wood samples and a phial of oil distilled from this wood, 'a small chest containing shells collected on the beaches, fruits, plants, etc . . .' was received by the Gentlemen XVII of the Dutch East India Company (Schilder 1985). Nicolas Witsen was given the fruits of a cycad. The eventual fate of these

'first fruits' is not recorded, but it would be surprising if the inquisitive Witsen, who had a passion for botany and had introduced the coffee plant into Holland (Engels 1986, Nelson 1984), did not have some of them sown.

William Dampier's curiosity about the plants of the north-western coast is well known (George 1971, Marner 1988, Nelson 1984); he reported that some of them '. . . had fruit like peascods; in each of which there were just ten small Peas . . .'(Dampier 1703). But did he bring any seeds back to England? Lemmon (1979) claimed that Dampier introduced *Clianthus formosus*[4]* into England, but it is a claim that is not sustainable, and considering the fate of HMS *Roebuck* (cf Lloyd 1966, Spencer 1981) is somewhat improbable.

The first Australian plants reliably recorded in European gardens arose from seeds collected during from the first of James Cook's voyages (Nelson 1983). Banks and Solander spent eight days at Botany Bay collecting and gathered approximately 3,500 specimens representing about 250 new plant species (Stearn 1969) but they did not collect seeds in such vast abundance, and they had no gardener with them.

The imbalance between seeds and herbarium specimens is not at all unusual; indeed it is a characteristic of any botanical field-trip. If plants are in bloom, fruits and seeds generally will not be available. If seeds are ripe, the collecting of herbarium specimens (which almost inevitably will not have flowers) is not so meritorious. Seed-collecting and the making of herbarium collections of taxonomic value are almost mutually exclusive.[5] Banks and Solander collected herbarium specimens including examples of fruits, but had not the opportunity deliberately to gather seeds for garden purposes. Another fact about field-work is this: to gather a branch or a inflorescence for the herbarium may take a few seconds (perhaps a few minutes if the specimens are pressed and labelled on the spot), but *to find* and then collect *sufficient* seeds to ensure reasonable success in establishing a species in cultivation takes many more minutes. Thus time alone explains why most collectors who have gathered excellent herbarium material have not also well-served the horticultural fraternity and, conversely, those who facilitated gardeners by gathering fruits, rarely are deemed worthy by herbarium botanists because they did not also collect good, flower-laden specimens.

Between 1771 and 1788, seeds did reach British gardens from Australia and New Zealand, but only nine Australian plants are definitively recorded in cultivation during this time (Nelson 1983); they initiated the period in Europe's horticultural history which Kraus (1894) termed 'Zeit der NeuHollander' (Stafleu 1969). There must have been a few other Australasian plants in European gardens at this time, but unflowered and so nameless, their presence was not noteworthy; it is possible that evidence of such plants is extant in manuscripts and herbarium collections, but no-one has systematically searched for that information.

* In general, botanical names quoted in this paper are those used by the original authors, or in the contemporary publications. Orthography has been corrected, but few attempts made to equate the names with modern taxonomic opinions. Thus authorities are omitted. The problems of equating the cultivated taxa with modern species are noted on pp. 290–292.

The First Fleet and its aftermath

The arrival of the First Fleet was as seminal an event in the history of Australian horticulture as it was for *Terra Australis Incognita*. The new residents of Port Jackson brought with them European, South American and Cape plants, thus initiating an invasion of aliens (Parsons 1981, Gilbert 1986, Wace 1986). Eventually the 'First Fleeters' found opportunities, which were not available to the tourist-naturalists, to gather seeds of the indigenous plants and to pack them, according to instructions, for shipping to Europe.

It is remarkable that Sir Joseph Banks did not transplant a gardener or botanist with the Fleet (Gilbert 1981, 1986), but instead put his faith, and hopes of acquiring plants, in the surgeons and officers. Seeds, herbarium specimens and botanical paintings were gathered by Governor Arthur Phillip, Surgeon-General John White and others. Each sent materials to different contacts — there was no single conduit for the much advertised '. . . non-descript productions'[6] of New South Wales which soon appeared in London. Dr White provided Thomas Wilson with fruits of *Banksia*, *Eucalyptus* and *Xylomelum* (these were drawn and then exhibited in London) (White 1790) and later he lent his collection of botanical paintings to James Edward Smith (1793). Dr Denis Considen sent the seeds and resin from the 'yellow gum' (*Xanthorrhoea*) to Sir Joseph Banks (Considen 1790, Nelson in prep.). Apparently others sent seeds to James Lee at the Hammersmith nursery for Governor Arthur Phillip's (1789) published journal included this note:

> Of the plants in general which have been brought from Botany Bay, and the adjacent country, no notice has been taken in this work . . . Many of them are now to be seen in the highest perfection at the nursery gardens of that eminent and learned botanist, Mr Lee . . .[7]

There are no easily computable figures for the quantity of natural history specimens leaving Port Jackson in those early days — certainly each ship returned to Europe with some curiosities. For seeds and particularly for live plants that journey was hazardous; even if the ships were not lost or wrecked, many factors combined to diminish the success-rate.

Packing and transport problems

Today we think little about collecting ripe seeds, drying them and putting them in paper bags; most will survive well if treated this way although their viability may diminish (Gorer 1978). However, in the late eighteenth century, the task of keeping seeds dry and away from the vermin aboard ship was not so easy; damp conditions, salt spray, and rats all took a heavy toll, which is why Lee and others suggested various elaborate methods for preserving seeds (Desmond 1979, 1987a).

Transporting living plants was even more difficult, and the principal causes of death were over-heating, rotting, poisoning with sea-salt and even drying out (Desmond 1987a). Plants were successfully carried on long sea voyages if elaborate preparations were made to protect them from heat, by shading them from the sun, and from sea-spray — Bligh achieved remarkable success with bread-fruit (see below), but the more general result was that only one in every thousand plants reached their destination alive (Livingstone 1822).

Not until the mid-1830s was there substantial improvement when the glass-panelled Wardian Case was 'invented' (Ward 1842); living plants could be sealed into these and salt-spray was excluded effectively. Glass-topped cases had been employed aboard HMS *Bounty* during the famous bread-fruit voyage by David Nelson, who was precisely instructed '... to preserve the trees and plants from the salt dew arising from the sea...or...to wash it off with freshwater', and earlier by Archibald Menzies (Anderson 1960, Galloway and Groves 1987) on HMS *Discovery*, and by French expeditions (cf. Brosse 1983, pp. 84–85), but their's were not sealed containers so salt-water could percolate into the plant chamber (Desmond 1987a).

In the last decade of the eighteenth century, a nursery-garden for indigenous plants was formed at Port Jackson (Gilbert 1986) to hold specimens that were destined for England, but how many living plants were successfully transported cannot now be ascertained. A note in Curtis's *The botanical magazine* about *Metrosideros citrina*[8] is the first printed account of a successful transplant of a whole plant. David Burton sent sixty tubs to Kew on HMS *Gorgon* in December 1791, and further fifty tubs were ready before his untimely death. *Campanula gracilis*[9], raised by Curtis from '... mould that came with the roots of other plants', may have come from one of these. On 7 June 1793, 182 boxes and tubs 'supposed to be a present ... from Gov'R Philips'[10] were brought to the Royal Gardens, Kew. Not long afterwards, William Aiton recorded the receipt of 'a box containing seeds and roots collected by Mr Menzies ... among which [are] curious Banksias &c. ...'[11]; seeds from William Paterson, who was stationed on Norfolk Island, and from Governor Phillip also were received that same day. Thus by 1793, plants from eastern Australia, the south-west and also Norfolk Island, flourished in the Royal Gardens, Kew.

Phillip, White and Paterson were amateurs; in 1791 the hapless David Burton arrived at Port Jackson as collector for Banks (Gilbert 1986), and in the succeeding years other professional collectors and itinerant botanists came to New Holland — Archibald Menzies, George Caley, Robert Brown (Edwards 1976, 1981a, Mabberley 1985), Peter Good (Edwards 1981b), Richard and Allan Cunningham to name but a few — and all contributed to the increasing population of New Holland plants growing in European gardens.

Botanical periodicals in England

News of successful introductions — usually once the plants had bloomed — was passed to gardeners through the botanico-horticultural periodicals that became fashionable at this time (Desmond 1977, Edwards 1979, Henrey 1975); Australasian plants were also noted in works which had no illustrations, such as William Aiton's *Hortus kewensis* (1789, 1810) and Richard Salisbury's *Prodromus stirpium in horto ad Chapel Allerton vigentium* (1796, Britten 1916). The colourful illustrations in the periodicals undoubtedly fostered the image of the New Holland's 'immense botanical treasures'.[12]

William Curtis (Desmond 1987b, 1887c), who had a private botanical garden (in reality a nursery) at Brompton, initiated the procession of illuminating publications with *The botanical magazine* in 1787 — it was the first and is now the sole survivor. The first Australian species displayed by him was *Acacia verticillata*[13], the plate based on a plant then in cultivation in William Malcolm's nursery; L'Heritier (1787) had depicted it in *Sertum Anglicum*. The New Zealand tree, *Sophora tetraptera*, which had been planted out-of-doors in Chelsea Physic Garden about 1774 — it was one of the introductions from Cook's first voyage (Nelson 1983) — was figured in 1791.[14] The next Australian species was not illustrated until April 1794 (*Metrosideros citrina*) when it was stated that the plant had come as a 'root' from Botany Bay[15]; the illustration was based on a shrub in Lord Cremorne's collection, and Curtis noted that the species had also flowered at Kew and Syon. A clutch of legumes followed — *Glycine bimaculata*, *G. rubicunda* and *G. coccinea*[16] — illustrating one of the principal characteristics of the early introductions, a preponderance of species with woody fruits or hard-coated seeds (see also Cavanagh 1981, 1982, 1983a, b).

Most plants raised in these early decades of 'Zeit der NeuHollander' were shrubs and inevitably took many years to reach maturity and bloom. The young, unflowered plants were frequently propagated and as seed was not available this was achieved by taking cuttings; it is remarkable how successful nurserymen were in striking cuttings of such plants as *Banksia* (Cavanagh 1983a) and *Acacia*. *Correa* was one of the most amenable genera and *C. alba* soon became common in collections (cf. Mackay 1826).

The popularity of Australian plants was not especially fostered by William Curtis; up to the beginning of 1800 only eight Australian species had been displayed in *The botanical magazine*. The chief display-case for New Holland plants was *The botanist's repository* published and illustrated by Henry Andrews (Henrey 1975), with the assistance of his father-in-law John Kennedy. The first issue appeared on 1 November 1797, and the second plate portrayed *Springalia* [sic.] *incarnata* (from a specimen cultivated in Lee and Kennedy's nursery). *Correa alba* followed.[17] William Paterson's introductions were prominent in Andrews's periodical, many depicted from plants in the care of Lee and Kennedy — *Acacia stricta*, *Goodenia calendulacea* and *G. ovata* were explicitly said to have arisen from Paterson's seeds. The first volume of *The botanist's repository* contained nine Australian plants; volume 2 contained eight, volume 3 had eleven, and in volume 4 the twelve Australian illustrations included *Banksia praemorsa* from Menzies and *Hibiscus patersonius* from Norfolk Island.[18]

Other publications detailing Australasian species were not so voluminous nor so richly embellished from garden plants. James Edward Smith's (1793) *A specimen of the botany of New Holland* was not based on cultivated sources, but on drawings and specimens sent to London by Surgeon-General John White; however, there are references in the text accompanying the sixteen plates to cultivated plants. Smith (1797) also noted garden specimens of *Eucalyptus corymbosa* and *Leptospermum lanigerum*, for example, in his paper on the 'Natural order of Myrti' and often included the negative information that he had seen no living example of certain species. In 1804, Smith began publishing *Exotic botany*, employing a mixture of her-

barium specimens and field sketches, and cultivated plants as models for the plates. He wrote thus:

> The chief aim of this present undertaking is not to cooperate with those publications which only describe plants actually blooming in the English gardens . . . it will rather be the object of our labours to introduce to the curious cultivator plants worthy of his acquisition and to teach those who have correspondents abroad what to inquire for.[19]

Be that as it may, the first illustration — *Humea elegans* — was prepared from a plant in Lady Amelia Hume's garden! Of *Blandfordia nobilis*, Smith noted that '. . . we are told there are living plants in England', whereas he wondered if the seeds of the *Tetratheca* species depicted '. . . have not been collected, or whether they will not bear so long a voyage as we have never heard of any plants being raised in Europe.'[20] Of *Epacris*, Smith stated that none was yet raised in England; he was apparently unaware that there were plants in the Royal Gardens at Kew.[21] On the other hand, *Viminaria denudata* and *Melaleuca thymifolia*[22] were depicted by Sowerby using living plants as models. *Exotic botany* contained thirty nine Australian plants, and ceased publication after only two volumes.[23]

In the early decades of the nineteenth century publications about garden plants in general proliferated in Britain. The Horticultural Society was established in 1806 (Fletcher 1969) and began issuing its *Transactions* in 1810; the first volume concluded with a long paper by one of the founders, Richard Salisbury (1812), on the cultivation of rare plants in which seven Australian plants are noted (Salisbury therein altered the generic name *Anigozanthos* to *Anigosia*, and noted that this kangaroo paw had flowered in the open air near East Cowes). Three years earlier, another founding father of the Horticultural Society, Joseph Knight (Willson 1982) had published the infamous monograph on cultivation of Proteaceae about which mystery remains (Knight 1809, Rourke 1987) as well as accusations of fraud and plagiarism; perhaps the text was by Richard Salisbury, but that enigma remains to perplex and amuse 'botanical archaeologists' (Rourke 1987).

Sydenham Edwards, an accomplished botanical artist, began *The botanical register* in 1815, while George Loddiges, an artist and nurseryman, founded *Botanical cabinet* in 1817 (Henrey 1975). Both Loddiges and Edwards obtained ample material among those Australasian plants already well-established in Britain for their separate periodicals. William Hooker, Professor of Botany at the University of Glasgow, issued three volumes of *Exotic flora* (with ten plates of Australian plants[24], but not all were from cultivated plants) between 1825 and 1827, abandoning it when he took over the editing of *Curtis's botanical magazine* following the death of John Sims. Robert Sweet, obviously a difficult, neurotic person who nurtured a personal vendetta against Kew and William Townsend Aiton, published *Flora australasiaca* in 1827 and 1828 — this single volume work contained 56 coloured plates, all executed from plants grown in or near London, and many raised from William Baxter's seed.

The horticultural periodicals were not primarily scientific works — they were issued to amuse and incidently to inform wealthy garden owners. The plants they depicted were grown for amusement, or because they were fashionable, not for scientific advancement — this is clearly stated when plants did not live up to aesthetic expectations (*Diplolaena dampieri* was condemned in one sentence — 'It can only now be regarded as a botanical curiosity'[25]).

Australasian plants in continental Europe c. 1800

Important botanico-horticultural publications were not produced solely in Britain, nor was the cultivation of Australasian plants confined to gardens in the United Kingdom. Exotic plants were as fashionable on the continent, where garden owners just as eagerly flaunted their new acquisitions.[26]

Ventenat's *Jardin de La Malmaison*, contained 46 Australian species[27] and two from New Zealand; this was one of the most sumptuous of the volumes including Australasian plants, and it shows that in Paris, at La Malmaison, considerable attention was given to their cultivation (Ventenat 1803). *Metrosideros anomala* and its compatriots were kept in the orangery during the winter — 'Il passe l'hiver dans l'orangerie'.[28] Quite a few reached France from England despite the Napoleonic wars: *Nicotiana undulata* was 'cultivee de graines envoyees d'Angleterre par M le Chevalier Banks'[29], and *Bignonia pandorea* from Norfolk Island, raised by Lee and Kennedy, was donated by Kennedy to the Empress's garden — for such largesse, Ventenat dedicated *Kennedia*[30] to the English horticulturist. There were also frequent notes to species other than those illustrated growing at La Malmaison. A handful of plants raised from seeds collected during Captain Baudin's expedition[31], including *Hibiscus heterophyllus*, *Apium protratum* and *Josephinia imperatricis*[32], also featured. Ventenat's book was issued in parts between April 1803 and November 1805. Redoute's monograph (1802) on the Liliaceae included just four Australasian plants — *Dianella caerulea*, *Anigozanthus flavidus*, *Sowerbaea juncea* and *Phormium tenax*[33] — as did Jacquin's *Plantae rariorum horti caesarei schoenbrunnensis* (1797–1804).

The traffic in Australasian plants between England and the continent, despite the unsettled state (cf. de Beer 1960, Nelson 1975, Carr and Carr 1978), is confirmed by records for the Royal Gardens at Kew. In June 1795 the Grand Duchess of Russia was sent *Banksia* plants and an unnamed species of *Crinum*[34] from Botany Bay, along with the sensational American *Fuchsia coccinea*. *Goodenia ovata*, *Sophora microphylla* and *Pittosporum undulatum* were included in a gift of over fifty plants dispatched in Spain in November 1796.[35] Her Sicilian Majesty was a recipient of *Telopea speciosissimum* late in 1800.[36] However, the Royal Gardens was not always so generous with surplus plants of which it had perhaps many, and was thus criticized in the 1820s by John Lindley:

> It is right, that in all questions about the period at which plants have been introduced, this distinction should be borne in mind, and that the world should be aware that the introductions of a plant to his Majesty's garden at Kew, is a very different affair from its introduction to Great Britain. An object cannot be properly said to be introduced from one country to another, unless it is afterwards disseminated by such means as the introducers possess; a practice which is adopted in every establish-

ment in the world, save in that one which ought to set an example to all others.[37]

The zenith of Australian plants, 1800–1835

From the scientific point of view, the Royal Gardens at Kew was the most significant recipient of plants. On 4 May 1806[38], Robert Brown visited Kew (Edwards 1981) listing in 'Plantae Novae Hollandiae in Horti Regio Kewensi crescentes. . .'[38] sixteen *Banksia* spp.[39], four *Lasiopetalum* spp. and at least eleven *Acacia* spp. Doubtless Brown's list was nothing like complete; it is, however, a fascinating document including the generic name *Threlkeldia*[40] which Brown did not publish for another four years (Wilson 1975). Many of these plants originated from Peter Good's seed which was received at Kew between 1803 and 1804[41] (Edwards 1981a, 1981b). Brown himself had collected seeds in Tasmania and New South Wales, after Good's death. Other plants had come from residents, including Governor Bligh who donated seeds.

At this time, William McNab was a gardener at Kew (Fletcher and Brown 1970), and gathered herbarium specimens from the plants growing there, indeed from those plants that Robert Brown saw and listed. McNab's Kew herbarium specimens (now in the National Botanic Gardens, Dublin (Nelson 1980, 1989a)) are of considerable importance as there is no similar material extant for this period in other herbaria; frequently McNab's specimens are annotated with the name of the original introducer — Robert Brown, Peter Good, George Caley, William Bligh are examples — and other comments about whether the plants were noticed in the second edition of *Hortus kewensis* (Aiton 1810). In May 1810 McNab left Kew to return to Edinburgh as curator of the Botanic Garden, and brought with him many plants — his friend Patrick Neill remarked that McNab was 'good at striking cuttings of *Banksia*'.[42]

Other botanical gardens had Australian plants — at the relatively new garden belonging to the Dublin Society at Glasnevin, outside Dublin, over seventy named Australian plants were being grown in 1802 and the majority of these undoubtedly came from Lee and Kennedy (Nelson and McCracken 1987). Some died within the next few years, but additions and replacements were found, and twenty six new taxa are included in the 1804 catalogue.[43] By 1838 the total had risen to over 200 species representing at least 60 genera.[44]

I cannot survey the whole history of Australian plant introductions in this paper (summaries are available in e.g. Coats 1969, Gorer 1978, Elliot 1980) but it may be useful to summarize briefly the following decades noting trends and a few particular incidents.

Although it is generally believed that the success rate for transporting plants in unglazed cases was low, Australian plants do seem to have survived the long journeys from the Antipodes tolerably well — the fact that most came from coastal localities may have had something to do with this.

Allan Cunningham was one of the major sources of living plants in the 1820s, and his introductions were prominent in *Curtis's botanical magazine*. In March 1821 a consignment arrived from him at Kew packed in '*Lycopodium uliginosum* being the only moss to be procured in quantity near Parramatta'.[45] In February 1822, cases contained *Patersonia* spp., eucalypts, ferns and *Telopea speciosissimum* which was always in demand (Nelson and McCracken 1987). Over the next few years, before returning to Europe, Cunningham sent Kew a substantial quantity of plants, including many orchids (enclosed in '. . . an open large case . . . securely protected from vermin during the passage to England'[47]), and soon these decorated the pages of *Curtis's botanical magazine*. In 1824 he included the first plant of *Fuchsia excorticata* from New Zealand (Brooker *et al.* 1988; Nelson 1989b).

Richard Cunningham, Allan's brother, also sent plants from Sydney Botanic Gardens to James Townsend Mackay at Trinity College Botanic Gardens, Dublin (Nelson 1988), in August 1833, including 'terrestrial and parasiticial orchids by way of an experiment'.[48] Not many months later Richard Cunningham received in Sydney the first of Nathaniel Ward's special closely-glazed cases full of living plants — ferns, mosses and grasses. 'Allow me,' wrote Captain Charles Mallard R.N., who escorted the cases to Sydney, 'to offer you my warm congratulations upon the success of this simple but beautiful discovery for the preservation of plants in the living state upon the longest voyages, and I feel not a little pride in having been the instrument by which the truth of your new principle has been fully provided by experiment' (Ward 1842). In Ferbruary 1834, Richard Cunningham filled these 'Wardian cases' with Australian plants, including *Gleichenia microphylla* (and unwittingly the seed of *Callicome serrata* which germinated en route), and returned them to London where they were joyfully opened by Ward in the presence of George Loddiges (Ward 1842).

Before that, there were other successful hitch-hikers! Captain Philip Gidley King, on his return from Australia in April 1823, presented 'his Majesty's garden [Kew] with one good plant of *Cephalotus follicularis*, and one or two doubtful ones with some bog moss and earth from King George Sound'[49]; the Albany pitcher-plants bloomed at Kew in 1827 and were figured in a pair of plates in *Curtis's botanical magazine*. The bog moss and earth harboured tubers of the orchid *Microtis media* which was also drawn for the journal.[50]

Cunningham, Fraser, Gunn and Baxter were the principal collectors in Australia during the 1820s and 1830s (cf. Gilbert 1986). William Hooker published a series of Australian plants in *Curtis's botanical magazine*, the zenith being 1833 — beginning with *Melaleuca fraseri* and concluding with *Marsdenia flavescens*.[51] *Curtis's botanical magazine* vol. 60 contained 28 plates of Australian plants[52] (and *Plagianthus divaricatus* from New Zealand), vol. 61 had just 16 plates[53] including *Trachymene lanceolata* (another of the waifs that sprang up in the earth of other things), vol. 62 had 18 Australian species[54], vol. 63 had 10 Australian plants.[55] The latter volume also contained the tragic 'seeds' of the overthrow of Australian plants as popular garden subjects in north-western Europe.

Australian plants become unfashionable, 1835–1870

A portrait of the Scottish collector David Douglas (Coats 1969) followed the plate of the Tasmanian *Veronica labiata*. Douglas was the first of Sir William Hooker's 'botanical martyrs', his mysterious death in an Hawaiian bull-pit was sensational and his plants

were just beginning to blossom in Britain (cf. Coats 1969, Gorer 1978). Thomas Drummond's equally mysterious demise in Havana in the same year enlarged the botanical martyrology and his plants too began to arouse great excitement. Hooker could only include four Australian plants in the 64th volume (along with *Clianthus puniceus* from New Zealand[56]) and three in the 65th of *Curtis's botanical magazine*, and four in the 66th volume.[57]

In March 1841 Sir William was appointed Director of the Royal Botanic Gardens at Kew (Desmond 1975), and there was a slight increase to seven plates in that year's issue.[58] James Drummond, Thomas's older brother, now entered the list of introducers with *Brachyscome iberidifolia* and *Anigozanthos manglesii*, and by 1848 in Dublin, there were four young plants of his discovery, that most miserable — horticulturally speaking! — plant *Hakea victoria*, raised from seeds sent to the Archbishop of Dublin (Nelson and McCraken 1987). But the plants of the Fitzgerald River region found by James Drummond could not compete in British gardens with the annuals of Texas discovered by Thomas Drummond. The fashion for the New Hollanders faded — William Henry Harvey noticed the trend:

> After writing to you about the Banksia I thought I had ascertained it to be B. occidentalis, but Moore has sent it to Lindley who has had it drawn, and I suppose it will therefore appear in Paxton's Magazine — under what name I know not, I thought that it was too unfashionable for you and that you had quite enough to figure without going so far from home.[59]

New Holland was now Australia, and free settlers were sending plants and seeds home to their friends — witness the stream of material to gardens like Glasnevin[60]; the plants were frequently mundane but, of course, quite demanding in their growing requirements and so they often failed to flower. In short there was no longer excitement generated by the very peculiar plants of Australia. David Moore summed up the decline in a letter to Sir William Hookder dated 6 December 1870 (Nelson and McCracken 1987);

> We still manage to keep a good many of the Cape and Australian Proteaceae which I am very fond of — but like you I cannot get our people to take much interest in them. I have often to rescue them from death when they are placed in some out of the way place. I have never found too much peat earth good for Proteaceous plants. Good rich loam with sharp sand and only a little peat best. Above all things, they harbor too much water. Those that are thick and fleshy about the root will only flower well when exposed to the warm sun in some sheltered nook and allowed to be well parched for a month or six weeks after they have made their young growth.[61]

Fashions had changed and horticultural technology had advanced. Glasshouses had more efficient heating and better glazing systems and could be built loftier and more elegantly. In 1844 Richard Turner began erecting the Great Palm House in the Royal Botanic Gardens, Kew (Blunt 1978, Diestelkamp 1982), the ultimate monument to those men including Richard Cunningham, David Nelson and Peter Good who died while collecting plants for the edification of the botanists and gardeners of Europe. Weird cacti, luscious orchids (some from Australia) and rampaging passion-flowers began to fill the pages of *Curtis's botanical magazine* along with the glories of David Douglas and Thomas Drummond.

That is not to say that Australian plants were totally ignored by European gardeners; there was no longer a general craze to acquire and grow Australian plants and they were relegated to the scientific gardens and to the gardens of mild counties (e.g. Arnold-Foster 1948) where quiet experiments were being conducted by a special kind of gardener — the plantsman. Botanical gardens still received living plants, and collectors did send seeds and Wardian cases — for example Charles Moore in Sydney exchanged Wardian cases with his older brother David at the Royal Dublin Society's Botanic Gardens.

By the middle of the nineteenth century, beautiful hardy plants that flowered profusely out-of-doors and did not sulk like the Australian ones were in most demand. Travellers continued to bring back seeds as souvenirs, and expeditions were specially commissioned to seek for the '. . . hidden beauties . . . planted in the lost mountains'.[62] Michael Edgeworth and Edward Madden were pillaging the rich meadows and woodlands of the Himalayas (where the young Joseph Hooker would soon follow), and John Tweedie was ploughing a lonely furrow across the Argentinian pampas (Gorer 1978; Nelson and McCracken 1987). Robert Fortune had started to unlock the treasure chest of China. Their plants stole pride of place. And of course there were the giants — *Wellingtonia* (now *Sequoiadendron gigantea*) from California and *Victoria amazonica* from the Amazon basin. Flora was being worshipped in other lands and the haggard gum-trees of 'barren, desolate' Australia became passé.

Problems for taxonomists

The principal cause of taxonomic difficulties connected with the early cultivation of Australasian species in Europe is the simple fact that there exists a substantial and diverse group of Australian species described and named long ago not from wild, natural populations, but from garden plants. This circumstance particularly prevails in the decades before the publication of *Flora australiensis* (Bentham 1863–1878). Very few Australian species were named from cultivated plants after 1863 because George Bentham and his successors did not use living plants, their domain being the herbarium with its neatly pressed and labelled carcasses, more numerous and more informative perhaps than the few miserable plants that managed to survive the dim light and soggy soil of northern greenhouses.

The difficulties encountered by present-day taxonomists may be grouped into four catergories:

1. the date of publication of a name and the elimination of earlier sources;
2. the author of the name;
3. the typification of the name, in particular the location of likely type specimens; and
4. the equation of a now-defunct cultivated plant, at best represented only by a solitary herbarium specimen or a published figure, with still- extant wild populations.

The first three problems are also encountered by taxonomists working with herbarium specimens collected

in the wild; only the fourth is uniquely associated with garden plants.

1. Dates and earlier sources

The dates of publication of most botanical periodicals and books is now superbly documented by Stafleu and Cowan in the second edition of *Taxonomic literature* (TL-2: see this volume); this is an essential reference work for all taxonomists. That is not to say that new information will not be available from previously unexamined sources to indicate dates other than those revealed by the dilligent work of Frans Stafleu, Richard Cowan and their many collaborators.

I may give an example. Jonas Dryander's *Catalogus bibliotheca Banksianae* is not generally considered to be a botanical source, but it does contain names of plants which must be examined for priority. According to TL-2 the third volume of Dryander's catalogue was published on 9 November 1797, but Banks donated a copy to the Linnean Society of London on 3 October 1797[63] and I would consider that worthy of note in any controversial nomenclatural problem arising from *Catalogus bibliotheca Banksianae.*

What about eliminating the possibility of earlier names, both valid and invalid? Mabberley[64] has demonstrated with considerable force that we ignore ephemeral or 'unknown' publications at our peril. Stearn has also had to make a similar point with regard to the generic name *Burtonia* and the binomial *Hibbertia grossulariifolia* (Stearn 1982), in this latter instance because of a cancelled page in Richard Salisbury's *Paradisus londinensis.*

Let's deal with ephemera first. One major source of botanical names is nursery catalogues, and far too few botanists ever bother to consult these. Most of them contain only lists of names, but that is not an invariable rule. What would have been the consequences if William Malcolm has inserted a brief description alongside his entry for 'Metrocedros obliqui' (Nelson 1983) in his catalogue of 1778? Put simply we would have had a new generic name for *Eucalyptus* and a new specific name for the type species. However the general situation is that nursery catalogues do not include new binomials[65] probably because nurserymen relied on the botanists to name their plants — they were not competent to devise names nor to identify their seedlings, witness the fact that *Melaleuca hypericifolia* was thought to be an *Hypericum* until it bloomed[66].

But names did 'leak out'. It is evident that at the Royal Gardens, Kew, unpublished names were attached to growing plants — Robert Brown's manuscript list and William McNab's herbarium specimens confirm this. The McNab herbarium includes specimens inscribed with the generic name *Haxtonia*, a name not published until 1831 (by David Don); to be sure it may be argued that McNab labelled plants after 1831, but the same is cited in a contemporary manuscript — the Kew 'Inwards' book for 1808[67] — so we must conclude that the name was proposed and then placed on labels in the Royal Gardens. If any such names are discovered to have been published in nurserymen's catalogue with descriptions, nomenclatural problems will ensue.

Newspapers, non-scientific periodicals and non-botanical books[68] can contain names and descriptions, and the removal of the clause about incidental mention from the *International Code of Botanical Nomenclature* (ICBN; Greuter, McNeill *et al.* 1988) now means that any name accompanied by a description has to be considered. However, the proposal for some form of a register of current names, and a concommitant ruling that long-abandoned ones cannot be resurrected, will if agreed by the international taxonomic community obviate these difficulties in future.

The problem revealed by Stearn is another one that must exercise those few of us who are inclined to bibliographic pursuits. Cancelled pages in books and periodicals were by no means rare during this period as evidenced by copies in which the tell-tale instructions to the binders remain intact; clearly authors and their publishers were not embarrassed to issue new text if errors were encountered. Cancelling a page of text that is already published does not invalidate the publication under the ICBN, yet I know of no concerted attempt to check any of the major botanical periodicals for cancellations, nor can I say if the cancellations affect the nomenclature of other Australasian species than those noted by Stearn.[69]

2. Authorities

The authorities of names also need to be given careful consideration. The old 'chestnut' is the second edition of William Aiton's *Hortus kewensis* — most scholars now accede to the system of stating that names published in volume 1 are cited as 'Dryander in Aiton' (Dryander being the authority), and those in subsequent volumes as 'R. Brown in Aiton' (Brown being the authority) (cf. Stafleu and Cowan 1976).

Periodicals such as *Curtis's botanical magazine* present similar problems. Sometimes the text for an individual plate is signed, or there is some other indication of the name of the author. In the case of *Carmichaelia*, John Lindley signed the text and ascribed the name to 'Brown mss'. The current New Zealand flora (Allen 1961) cites Brown as the author although there may here be a case for 'Brown ex Lindley' (shortened to Lindley).

Similar difficulties arise with *The botanist's repository* for while Henry Andrews wrote the text of the first five volumes, Adrian Haworth 'conducted' the letterpress of volume 6, and George Jackson 'supervised' the remainder (Stafleu and Cowan 1976). The authorities for some species published therein are confused — *Veronica derwentiana*[70] from Tasmania is ascribed by Robert Brown to Littlejohn.

3. Typification

The typification of names of species described from cultivated plants may present many more difficulties than had the species been named from wild-collected herbarium specimens.

Did the original author use only cultivated plants or did he have both the cultivated plant and herbarium specimens in front of him? Such a question will be impossible to answer without careful examination of all the available material, both published and unpublished, and the herbarium specimens. If both cultivated and wild material were evidently used, preference might be given to selecting as a type a herbarium specimen for a known locality. But the ICBN does lay down rules about types and these must be applied.

Assuming that only a cultivated plant was available to the author, there may be considerable difficulties in finding a preserved specimen. A few sources of such specimens are well-known — the British Museum (Natural History), for example, contains herbarium specimens from the Royal Gardens at Kew, chiefly from the period before 1800 but nothing much, therefore, that can be used to typify plants described in the second edition of *Hortus kewensis* (Aiton 1810). William McNab's specimens gathered at Kew between 1805 and 1810 fill a portion of this lacuna, and some may serve as types (Nelson 1980); *Brachysema latifolia* (Crisp, 1989) and two species of *Acacia* (Maslin, in herb.) have recently been typified by specimens in Dublin. Like the cancelled pages, these specimens (and others from cultivated plants) should not be ignored, as their presence may result in an improper choice of type — such a choice must be corrected under the ICBN.

The more usual result of a search for herbarium specimens derived from a cultivated plant is that nothing will be located. In some cases drawings can be selected as types, and original watercolours for many of the drawings in *Curtis's botanical magazine* exist at Kew.

4. Equations

This may not seem of great importance, but the ICBN is being modified subtly at international congresses and we have to be aware of all difficulties. It is salutary to remember that the first Australian plants given Linnean binomials were fortuitously illustrated, and by equating those illustrations (both excellent) with wild plants the two taxa — *Acacia truncata* and *Synaphea polymorpha* (George 1971, Maslin 1978) — were identified.

The rule on monstrosities was abolished some years ago, meaning that specific names based on aberrant forms of plants could no longer be disregarded. This has resulted in some unhelpful changes which irritate both botanists and gardeners — for example a hybrid between two of the European species of *Erica* long known to Irish botanists and to horticulturists as *Erica* x *praegeri* must now be named *E.* x *stuartii*, a name based on an aberrant form, now a cultivar (*E.* x *stuartii* 'Stuartii') (Nelson 1979).

I do not know of any examples of Australian species based on monstrosities, but my perambulations through the various publications did reveal a number of strange dwarf cultivars — I have not investigated their names in detail but they are perhaps later synonyms.

Fortunately little horticultural experimentation was perpetrated on Australian species during the principal period of their cultivation in the early nineteenth century. Hybrids of *Correa* were produced deliberately, and perhaps also some in *Epacris*, but these are clearly signalled in the horticultural texts. Thus Australian taxonomists do not have to contend with innumerable variants that bedevil *Fuchsia*, for example, although anyone concerned with the nomenclature of cultivars should certainly not overlook these nineteenth century publications.

The cultivated plants depicted in the works I have reviewed display a syndrome of characters (mostly vegetative) that betray to the experienced eye their languishing in dull light, restrictive pots and a too-generous water-supply. Again, it is fortunate that most of the plants depicted in nineteenth century books and periodical were in bloom — non-blooming angiosperms were never painted for these pictorial volumes — so this is not a problem. But there are many names published without accompanying illustrations — for example in Salisbury's *Prodromus*[71] — and the original subjects ('type plants') were perhaps not typical of wild, native populations: without herbarium specimens, illustrations, or early attempts at synonymy these names will continue to be orphans, unassigned *nomina regicenda*, *nomina incertae sedis*.

Conclusions

The full history of Australasian plants in cultivation in Europe has yet to be researched, unravelled and recorded. The new awareness of the value of Australia's and New Zealand's endemic plants as ornamentals in antipodean gardens should stimulate interest in this neglected part of the heritage and cultural development of these nations. The primary documents for this history are in Europe scattered through the dusty, unloved archives of venerable institutions like the Royal Botanic Gardens at Kew, the National Botanic Gardens at Glasnevin, and the Jardin des Plants in Paris, and that may retard research, but not for long, I hope. Much progress has been made in recent years towards revealing the information contained in those archives; my own cursory glances at what does survive has revealed that while the general pattern of the history has been sketched in outline, the finer details remain to be inserted. In particular, claims of first introduction, unsupported by evidence from contemporary manuscripts and herbaria, need to be treated with extreme caution — the fact that authors continue to state that *Banksia serrata* was the first Australian plant grown in Britain, despite contemporary statement to the contrary and recent research papers (Nelson 1983), points out how far we must still go.

Australian plants have enthralled gardeners and beautified British, Irish and European gardens for more than two centuries. They continue to excite interest among those adventurous spirits (e.g. Talbot de Malahide 1967), the so-called plantsmen (of both sexes), who are the dynamos that keep horticulture fresh and lively. *Telopea truncata*, *Acacia dealbata*, *A. verticillata*, *Sollya heterophylla*, a handful of *Correa* hybrids, a respectable clutch of *Grevillea* cultivars and groves of stately eucalypts are relatively common in Ireland and Britain (cf. Connolly and Dillon 1986, Irons 1988). And there are many other species and cultivars (see e.g. Forrest 1985). *Dicksonia antarctica* and its New Zealand cousins imbue unique character to the gardens of counties warmed by the moist west winds (Arnold-Foster 1948, Morley 1979, Nelson 1989b).

Two centuries after the landfall of the 'First Fleet' at Botany Bay we may look back with a wry smile to George Jackson, the man commemorated by Robert Brown and Sir James Edward Smith in *Jacksonia*, who in eulogizing *Pomaderris lanigera* succinctly — and aptly for this particular *annus mirabilis*! — recorded the contemporary English opinion;

> To New Holland we export criminals for our convenience and safety, and from thence import furs for our covering

and flowers for our amusement. So far the balance of trade is in our favour.[72]

Notes

1. Quoted by Searle (1973), p. 17; Clarke, M. (1876). Preface. *In* Gordon A. L., *Sea spray and smoke drift.* (Melbourne).
2. From *Transmigration* (1778), an anonymous verse satirizing Banks and Solander, quoted in Smith (1985, pp. 46–47).
3. A recurring phrase from traditional folk-songs; see e.g. O'Shaughnessy, P., Inson, G. and Ward, R. (1968). *The restless years, being some impression of the origins of the Australians.* (Jacaranda Press, Milton, Qld.) p. 13.
4. The specimens collected by Dampier were in flower, apparently without fruits (see Marner 1988); on the fate of the *Roebuck*, see Lloyd (1966). Sturt's desert pea is first recorded in cultivation in Europe during the early 1850s [see *Flore des serres* . . . 6: 121–122 (1851)].
5. For discussion of this see e.g. Gorer (1978), pp. 13–37.
6. This phrase was frequently employed by authors in the late eighteenth and early nineteenth centuries, e.g. White (1790).
17. Phillip's journal was an edited compilation, so that this comment (Phillip 1789, p. 294–295) must have been interpolated by the English editor. As noted, Lee and his partner John Kennedy had a substantial interest in Australian plants, claiming as a 'first' *Banksia serrata* — but see Nelson (1983) and Cavanagh (1983a).
8. *The botanical magazine* pl. 260: now *Callistemon citrinus* (Cavanagh 1983b). This name for the magazine remained for vols 1–14 (1787–1801). It was changed to *Curtis's botanical magazine* for subsequent volumes. The common abbreviation for both titles, used herein, is *Bot. Mag.*
9. *Bot. Mag.*, pl. 691: now *Wahlenbergia gracilis.*
10. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book', entry for 7 June 1793 (brought by HMS *Atlantic*).
11. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book', entry for 18 June 1793 (received through Sir Joseph Banks; Paterson sent 20 papers of seed; Phillip '. . . brought home . . . 80 papers').
12. cf. Smith (1962, pp. 9–11).
13. *Bot. Mag.*, pl. 110: plants had already set seed in England.
14. *Bot. Mag.*, pl. 167: flowered at Chelsea Physic Garden in 1791.
15. *Bot. Mag.*, pl. 260.
16. *Bot. Mag.*, pl. 263, 268, 270: species of *Hardenbergia* and *Kennedia* which were noted, respectively, as having been introduced by J. Ord (*H. violacea*), being 'very generally known to nurserymen' (*K. rubicunda*), and having been 'very lately raised by several persons' (*K. prostrata*).
17. *The botanists repository*, [abbreviated herein as *Bot. repos.*] pl. 18: *Correa alba* was from J. Vere's garden, Kensington.
18. *Bot. repos.*, pl. 258, 286: *Banksia praemorsa* was erroneously stated to have reached the Royal Garden, Kew, in 1788. It was not introduced until 1792, and by 1802 a plant at Clapham had reached seven feet (c. 2m) in height. *Hisbiscus patersonius* had flourished especially in Lord Courtney's garden, Exeter.
19. Smith (1804), [abbreviated herein as *Exot. bot.*]
20. *Exot. bot.*, pl. 4. (*Blandfordia*); 21 (*Tetratheca glandulosa*); other species of *Tetratheca* were portrayed in pl. 20 (*T. ericifolia*), 22 (*T. thymifolia*).
21. *Exot. bot.*, pl. 39 (*E. grandiflora*), 40 (*E. obtusifolia*); Aiton (1810) listed species in the Royal Gardens, Kew.
22. *Exot. bot.*, pl. 27, 36: *Viminaria* had been in flower at Stockwell in 1794, and *Melaleuca thymifolia* was raised by J. and J. Fairbairn, nurserymen at Chelsea, as well as by Robinson at Stockwell where it bloomed in 1794.
23. *Exot. Bot.*, pl. 25 (*Dillwynia ericifolia*), 26 (*D.floribunda*), 27 (*Viminaria denudata*), 29 (*Thelymitra ixioides*), 30 (*Diuris maculata*), 34 (*Melaleuca ericifolia*), 35 (*M. nodosa*), 36 (*M. thymifolia*), 39 (*Diuris maculata*), 40 (*E. obtusifloia*), 41 (*Drosera peltata*), 42 (*Metrosideros hispida*), 35 (*Campanula gracilis*), 55 (*Melaleuca genistifolia*), 56 (*M. linarifolia*), 58 (*Gompholobium intricatum*), 59 (*Leptospermum ambiguum*), 66 (*Ventenatia major*), 67 (*V. minor*), 72 (*Correa virens*), 78 (*Eriocalia major*), 79 (*E. minor*), 82 (*Conospermum longifolium*), 83 (*Persoonia ferruginea*), 84 (*Eucalyptus resinifera*), 88 (*Solanum stelligerum*), 104 (*Arethusa catenata*).
24. Hooker's *Exotic flora*, pl. 8 (*Doodia aspera*), 24 (*Velleia lyrata*), 25 (*Doodia caudata*), 32 (*Stylidium laricifolium*), 96 (*Banksia verticillata*: flowered at Liverpool Botanic Gardens in 1813), 185 (*Galega tricolor*), 215 (*Pyrethrum diversifolium*: in Edinburgh and Glasgow Botanical Gardens), 216 (*Grevillea pubescens*: bloom in 1825 at Royal Botanic Gardens, Glasgow), 225 (*Viola hederacea*), 232 (*Fieldia australis*).
25. *The botanical register*, [abbreviated herein as *Bot. Reg.*] (1841), pl. 51.
26. see e.g. Kraus (1894); Duval (1982) makes only brief mention of Australasian plants.
It is difficult to gather information on Australasian plants cultivated in the gardens outside Britain and Ireland as few historical summaries, similar to those of Coats (1969) and Gorer (1978), have been published.
27. The plants depicted by Ventenat included e.g. pl. 2 (*Xeranthemum bracteatum*), 13 (*Correa alba*), 108 (*Andreusia glabra*: named for Henry Andrews).
28. *Jard. Malmaison*, pl. 5.
29. *Jard. Malmaison*, pl. 10.
30. *Jard. Malmaison*, pl. 104, 105, 106.
31. Introductions are attributed to Capt. Hamelin.
32. *Jard. Malmaison*, tab. 67 (*Josephinia imperatricis*), 81 (*Apium prostratum*), 103 (*Hibiscus heterophyllus*).
33. *Liliacees*, pl. 1 (*Dianella ensifolia*), 176 (*Anigozanthos flavidus*), 341 (*Sowerbaea juncea*), 448 [*Phormium tenax*: received originally in France from the Royal Gardens, Kew in 1800, but later introduced directly from Australasia by Baudin's expedition (*Le Naturaliste*) through L'Havre.]
34. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book', entry for June 1795 (ff. 42–43).
35. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book', entry for 9 November 1796.
36. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book', entry for 26 November 1800.
37. *Bot. Reg.*, pl. 1288: *Isopogon formosus* (raised from William Baxter's seed, gathered at Lucky Bay, Western Australia, 1824).
38. MS. in Department of Botany, British Museum (Natural History), London: in Edwards (1981, p. 24) the date is incorrectly given as 1804. It is possible that the date is 4 March 1806, not 4 May, but in reading the manuscript I consider that Brown wrote 'Mai' not 'Mar'.
39. These were named as follows: *B. praemorsa*, *B. verticillata*, *B. grandis*, *B. speciosa*, *B. repens*, *B. latifolia*, *B. oblongifolia*, *B. attenuata*, *B. serrata*, *B. ericaefolia*, *B. spinulosa*, *B. virens*, *B. platycarpa*, *B. asplenifolia*, *B. plumosa*, *B. sessilifolia* ?
40. Brown noted *Threlkedia glauca.*
41. For a later consignment — early 1805 — see MSS. in Royal Botanic Gardens, Kew: 'Inwards Book 1805–1809', entries:
'12 Mr Peter Good collected the following seeds in New South Wales. They were brought Home in the Calcutta Man of War. . .
13 Seeds from Mr Peter Good. 140 papers exclusive of Banksia's.
14 Banksia.'
42. MS. in School of Botany, University of Dublin (Trinity College), Neill to James Townsend Mackay 21 March 1811. McNab is a minor figure, but he knew many of the Scotsmen (Robert Brown included) who were so significant in the botanical world at this time, and he developed a keen interest in southern hemisphere plants which culminated in the publication of a small pamphlet — McNab. W. (1832). *A treatise on the propagation, cultivation and general treatment of Cape heaths* . . . (Clark: Edinburgh) — about the cultivation of *Erica* spp. from the Cape of Good Hope. For further information see Nelson (1980), Nelson and McCracken (1987).
43. Underwood, J. (1804). *A catalogue of plants, indigenous and exotic cultivated in the botanic garden belonging to the Dublin Society at Glasnevin* . . . (Dublin Society: Dublin) — for details of the published catalogues of Glasnevin Botanic Gardens, see Nelson (1981).
44. MS. in National Botanic Gardens, Glasnevin: catalogue of plants prepared by David Moore. See Nelson and McCracken 1987, pp. 100–102).
45. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book 1804–1826', entry for March 1821. (ff. 153–155).
46. MSS. in Royal Botanic Garden, Kew: 'Inwards Book 1804–1826', entry for February 1822. (f. 162).
In 1809, John Underwood, head gardener at the Dublin Society's Botanic Gardens, Glasnevin, had succeeded in obtaining a plant of *Telopea speciosissimum* from Loddiges for 10 guineas (about one tenth of his annual salary) — it was the only plant then available for sale, and he was informed that only two

English gardens, apart from Kew, possessed the 'waratah' (Nelson and McCracken 1987). [Nixon (1987) makes no mention of early cultivation of the waratah in Europe].
47. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book 1802–1826', f. 189.
48. MS. in School of Botany, University of Dublin (Trinity College): R. Cunningham to James Townsend Mackay, 1 August 1833.
49. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book 1804–1826', f. 165.
50. *Bot. Mag.*, pl. 3118 & 3119 (*Cephalotus follicularis*), 3378 (*Microtis media*).
51. *Bot. Mag.*, pl. 3210 (*Melaleuca fraseri*), 3289 (*Marsdenia flavescens*).
52. The Australasian plates in vol. 60 are numbered 3210, 3212, 3219, 3223, 3228, 3236, 3243, 3244, 3249, 3251, 3253, 3254, 3257, 3258, 3259, 3260, 3264, 3266, 3270, 3271 (*Plagianthus divaricatus* from New Zealand), 3272, 3274, 3276, 3279, 3281, 3285, 3288, 3289.
53. The Australasian plates in vol. 61 are numbered 3307, 3308, 3312, 3313, 3322, 3323, 3324, 3328, 3330, 3334 (*Trachymene lanceolata*), 3337, 3338, 3341, 3346, 3351, 3358.
54. The Australasian plates in vol. 62 are numbered 3377, 3378, 3394, 3396, 3399, 3400, 3401, 3405, 3407, 3415, 3417, 3419, 3420, 3421, 3424, 3438, 3443, 3450.
55. The Australasian plates in vol. 63 are numbered 3459, 3461, 3469, 3483, 3500, 3502, 3513, 3523, 3535, 3539.
56. The Australasian plates in vol. 64 are numbered 3582, 3584 (*Clianthus puniceus*), 3607, 3624, 3625.
Clianthus puniceus was introduced to Britain about 1830, following its discovery by missionaries, and bloomed in the summer of 1832. It was and still is a popular, but difficult plant, for northern European gardens. Soon after its first flowering John Lindley read a paper about it to the Royal Horticultural Society (see Nelson 1989b), and within a short period it was being illustrated in other places. Allan Cunningham, in a letter to William McNab of Edinburgh, written on 29 April 1837 in Sydney, asked:
Could you send me the seeds of Clianthus puniceus, which altho' a Native of N. Zealand near us, we have a diffy in obtaining plants from hence, and the locality of that beautiful scarlet fl is not fully understood.
MS. in Royal Botanic Garden, Edinburgh (McNab family scrapbook).
57. The Australasian plates in vol. 65 are numbered 3652, 3658, 3672, and in vol. 66 are numbered 3721, 3760, 3775, 3784.
58. The Australasian plates in vol. 67 are numbered 3798, 3816, 3826, 2833, 3857, 3875 (*Anigozanthus manglesii*), 3876 (*Brachyscome iberidifolia*).
59. MSS. in Royal Botanic Gardens, Kew: William Harvey to Sir William Hooker, 2 December 1850 (English Letters vol. 29: 338).
60. Between 1848 and 1879, 28 consignments reached Glasnevin from the Botanic Gardens in Sydney including in 1856 ten fine tree ferns from four to eight feet high; during the same period Melbourne Botanic Gardens sent four consignments (236 pkts of seeds).
61. MSS. in Royal Botanic Gardens, Kew: David Moore to Joseph Hooker, 6 December 1870 (English Letters vol. 95: 327).
62. Kingdon Ward, F. (1924). *From China to Hkanti Long.* (London). Quoted by Coats (1969, p. 86).
63. This copy is still in the Library, Linnean Society, London (G. Douglas, pers. comm.)
64. e.g. Mabberley, D. (1983). Dr Smith's *Anemia*, or, the prevention of later homonyms. *Taxon* 32: 79–87.
65. I examined, for example, the annotated series of catalogues issued by Messrs Loddiges (1804, 1807, 1811) and none contained descriptive notes; any names in these are *nomina nuda*.
Few catalogues about the turn of the eighteenth century contain Australasian plants. Loddiges's catalogues are perhaps the most interesting as they cover the period of Good's and Brown's introductions during which, as has been noted, unpublished names were available to gardeners at least those in favour at the Royal Botanic Gardens, Kew. [For details of these catalogues, see Harvey (1973, 1981)].
66. *Bot. repos.*, pl. 200. This was raised in 1792 by William Malcolm, and 'called an hypericum until it flowered. . .'
67. MSS. in Royal Botanic Gardens, Kew: 'Inwards Book 1805–1818', entry for 1808, f. 276 (three plants from George Caley named '*Haxtonia arborea*' (no. 359, Hobart), '*H. canescens*' (no. 363, 'Stapin Island Dec 1805') and '*Haxtonia* [ined.]' (no. 376, Hobart).
Don (1832, in *London Edinburgh Philos. Mag. & J. Sci.* 1: 272) stated 'Haxtonia nomen Asteri argophyllo Billardieri primum imposuit B. Georgius Caley', thereby obliging us to give Caley ex Don as the authority for the name. The reason why Caley chose to honour the obscure gardener John Haxton, who accompanied Lord Macartney on his famous Embassy to China, has not been discovered. *Index kewensis* and Burbidge (1963) are in error in attributing *Haxtonia* to Allan Cunningham.
68. cf. *Xanthorrhoea* which is predated by *Acoroides*, published in a medical journal The case is not perhaps relevant for cultivated plants, but how many botanists have examined the pharmacopaea issued in London after 1788 to see what names lurk therein?
69. One example I am aware of is in *Bot. Reg.*, pl. 912 (*Carmichaelia australis*, a New Zealand taxon); the original page bore the name *Lotus arboreus* Forst., and no description but a note saying that the '. . . letter-press . . . is unavoidably deferred until next month, in expectation of some interesting information respecting the plant from the pen of Mr Brown.' Robert Brown named the plant after Dugald Carmichael: the name was published in the issue of October 1825, not that of September 1825 as would be supposed from the date on the plate.
70. *Bot. repos.*, pl. 531 — see also errata wherein the specific epithet is corrected from the form '*derwentia*' to '*derwentiana*'.
71. See Barker & Barker, this volume; Britten (1916).
72. *Bot. repos.*, pl. 569.

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Early Austrian influence on Australian botany

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Abstract

Three Austrian botanists visited Australia within the first fifty years of settlement: Ferdinand Bauer, Franz Sieber, and Karl von Hügel. They differed in their backgrounds, itineraries and motivations; they left rich legacies of plant collections and publications.

At the end of the eighteenth century Vienna was the capital of the Holy Roman Empire, ruled by the Habsburgs. This multi-cultural, multi-ethnic realm included large parts of present day Germany. In 1792 Franz II had been crowned Holy Roman Emperor in Frankfurt. To Vienna, the third largest capital of Europe at the turn of that century, flocked musicians, writers and intellectuals, mostly conversing in the German tongue, and essentially German in their backgrounds and heritage.

In the rich setting of the Imperial State, the many palaces were surrounded by glorious gardens which showed splendid collections of plants. These were considered to be particularly valuable if they had their origins in distant lands. These plants were displayed and then portrayed by famous artists. It was the age of the production of beautiful books with illustrations of flowers grown generally in Royal or 'titled' gardens and hot-houses: flowers which only the wealthy could afford. This was the horticultural background in Vienna at the turn of the eighteenth century; thus it was similar to the situation in Paris or London. In all three cities there were botanists interested in the floras of remote countries (Riedl-Dorn 1988).

The end of the eighteenth century was also the age when, under the influence of Carl Linnaeus (1707–1778) and Antoine-Laurent de Jussieu (1748–1836), all plants were being named and classified according to a natural system. This necessitated detailed structural and anatomical investigation. Parts of the plants, particularly the reproductive parts, were dissected and, for communication with other botanists, illustrated. So the new combination of art and science — botanical illustration — was developed. It was thus, since the time of Linnaeus, that the exactness of plant portrayal became so important a tool of the practising botanist. This art developed in the Austrian capital just as much as the love of gardens, and the endeavours of exploration were fostered in this and other centres of Europe.

In the beginning of the nineteenth century three Austrian botanists came to New Holland (Ducker 1981a,b). They differed in their backgrounds, their education and their aims. All three are important for the development of Australian botany.

Ferdinand Lucas Bauer (1760–1826)*

The first Austrian botanist to arrive in Australia was Ferdinand Lucas Bauer. Ferdinand and his elder brother Franz Andreas (1758–1840) were the sons of a Court painter to the Prince of Liechtenstein in Feldsberg near Vienna. They were discovered by, and worked for, the Dutch-born Professor of Botany and Chemistry in Vienna, Nicolas Joseph von Jacquin (1727–1817), who brought the brothers to Vienna. He introduced them to the morphology and anatomy of plants, a knowledge so necessary for the art of botanical illustration. It was Jacquin who pioneered the artistry of informative botanical drawings which was later perfected by his students, the Bauer brothers. At first the brothers were employed under his supervision to make the drawings for some instalments of the *Icones plantarum rariorum* (1781–1793). These illustrations were then reproduced as copper engravings and printed on 12 copies only of elephant folios. It is important to remember that the brothers learned botany, drawing and engraving from Jacquin. They were thus well equipped for the things to come (Stearn 1976).

John Sibthorp (1758–1796), Sheradian Professor of Botany at Oxford, on his way to the Ottoman Empire in 1786, met Ferdinand in Vienna. Sibthorp was researching the *Codex Vindobonensis* in the Imperial Library. This manuscript, *De Materia Medica*, had been written in Constantinople in the sixth century A.D. and contained paintings of the plants used by the herbalist Dioscorides in the first century. Sibthorp was so impressed with Ferdinand Bauer that he engaged him as illustrator for his journey to Greece and Turkey. The botanical results of this journey were published later in *Flora Graeca prodromus* and *Flora graeca* (1806–1840), the latter with beautiful engravings based on watercolours by Ferdinand.

While Ferdinand was in England his brother Franz came to visit; there and then, in 1788, Franz was engaged by Sir Joseph Banks as a salaried botanical draughtsman to the Royal Gardens at Kew. Franz

* Ed. note: this paper is essentially that which was presented at the symposium. Since then the following book has been published: Norst, Marlene J. (1989). *Ferdinand Bauer. The Australian natural history drawings.* 120 pp. (Lothian Publ. Comp.: Melbourne).

Bauer illustrated many Australian plants, both from various collections made in Australia and also specific ones to illustrate the writings of Robert Brown. He remained at Kew for the rest of his life where he was buried in the churchyard of St. Anne on Kew Green only a few steps from his house and from Kew Gardens.

On 12 December 1800 Sir Joseph Banks wrote to Robert Brown

> . . . a ship is this day order'd to be fitted for the purpose of exploring the natural history of New Holland, & it is resolved that a naturalist & a Botanic Painter shall be sent in her.

I have no record of how Banks approached Ferdinand Bauer to join the team who, with Matthew Flinders, sailed in HMS *Investigator* to Terra Australis. But Bauer left his work in England and sailed in July 1801 to Australia. In December of that year Cape Leeuwin was sighted by the sailors. From there they sailed to King Georges Sound and thence to Doubtful Bay (Mabberley 1985). In Western Australia the botanists Brown and Bauer and the Scottish gardener Peter Good (?-1803; Edwards 1981) collected about 500 specimens of flowering plants. Many illustrations record Bauer's activity during the subsequent circumnavigation of Australia. Brown was the naturalist, observing plants and animals alike, while Bauer made drawings of plants and animals.

After the circumnavigation of Australia, fate played a peculiar game with the scientists of the *Investigator*. Flinders went home to replace the leaking *Investigator* with a better ship. While he returned in the ill-fated *Porpoise*, Brown and Bauer decided to remain in New Holland to await Flinders' return. Bauer collected plants and seeds around Sydney. Australian orchids were grown from these seeds in hot-houses at Kew Gardens, and some of these were later portrayed by Franz Bauer in *Illustrations of orchidaceous plants* (1830–1838) with a text by John Lindley (1799–1865), the famous London botanist.

From Sydney Ferdinand Bauer visited Norfolk Island. His plant collection was immortalized in *Prodromus florae Norfolkicae* (1833) by Stephan Ladislaus Endlicher (1804–1849) who, as a successor to Jacquin, was Professor of Botany in Vienna. Both Ferdinand Bauer and Robert Brown returned to England in the repaired *Investigator* in 1805 while Flinders was held captive on Mauritius by the French.

Ferdinand Bauer's drawings from Australia were a marvellous complement to the herbarium specimens of Brown. The illustrations were done under the watchful eye of Brown. They showed the salient botanical characters of the new plants as well as the pertinent features for classification. As Bauer had done so many sketches and colour coded his pencil drawings of the specimens in the field, the colouration of the flowers and fruits was correct and not spoilt by being painted from dead herbarium specimens. Of the animals, perhaps the best examples are of marine animals, such as the crabs and sea horses. The brilliant hues of the paintings show that they were recorded from almost fresh organisms, before the discolouration in death had progressed.

Between 1806 and 1813 Ferdinand Bauer worked on his *Illustrationes Florae Novae Hollandiae*. As he insisted on colouring these himself, fewer than fifty copies were printed. This is the only book published in his name in 1814. In the same year his ten botanical illustrations for Flinders' *Voyage to Terra australis* (1814) were published. In 1814 Ferdinand said goodbye to Franz and to Robert Brown. He returned to his native land where he died in Vienna in 1826.

In 1833 Endlicher published the *Prodromus florae Norfolkicae*, enumerating all the plants collected by Bauer on Norfolk Island: lichens, bryophytes, ferns and higher plants. There were 117 illustrations selected but not published with this book. The originals, done while Ferdinand Bauer was on Norfolk Island, are in Vienna in the Natural History Museum with, according to Blunt (1950), more than 2,000 other unpublished Ferdinand Bauer drawings from Australia. There is also a large number in the British Museum (Natural History), Kensington. Stearn (1976), with the Basilisk Press, published 25 of the beautiful water colours. During the Australian Bicentenary year, 1988, some of Ferdinand Bauer's illustrations were reproduced, and so made available to the Australian public (Mabberley 1985; Eisler & Smith 1988; Steven 1988). They are not only one of our great heritages but also a help to the practising botanist.

Franz Wilhelm Sieber (1789–1844)

Sieber (Fig. 1) was one of the earliest botanists who collected Australian natural objects as a commercial enterprise. Born in Prague (30 March 1789) from well-to-do parents and highly gifted, Sieber trained as an architect and engineer but soon changed to the study of natural sciences, particularly botany (Weitenweber, 1852). He realized that there was a good market for the sale of herbaria and live plants, and started to advertise botanical collections from European countries he was about to visit. After a few collecting trips, he returned to Prague to take up the study of medicine, but did not complete the degree. Following this, he visited Egypt and Palestine collecting and later selling the plants, herbaria and seeds in Munich, Vienna and his home city, Prague (Dietrich 1881).

Soon he prepared to venture further afield and sailed with Karl Zeyher (1799–1858) from Marseilles

Fig. 1. Portrait and signature of F. W. Sieber (Glückselig 1847).

in *Les deux Nouvelles Nanettes* (22 August 1822). At the Cape of Good Hope, Zeyher disembarked for his now famous collecting period. Sieber sailed on to the Ile de France, now Mauritius, arriving on 12 December 1822. On the ship *Midas* he left for Sydney (8 April 1823) where he arrived on the first of June 1823.

Sieber (1824) described his impressions in a letter from Sydney dated 4 August 1823: 'he was delighted with the splendour and richness of the flora. Although it was winter, the country parched, and the streams without water, he had collected 300 different species in the Colony Jackson composed of 64 square miles'. He also recorded that he had been to the Blue Mountains, 60 miles from Sydney, and seen a miraculous vegetation, had travelled 120 miles along the seashore to collect marine vegetation including seaweeds and had met Mr Cunningham who introduced him to 150 species of *Acacia*. He subsequently commented on 'the black swans and the droll voices of the magpies, simulating human voices and modulations of tone'.

Sieber was lucky to meet the English botanist, Allan Cunningham (1791–1839), who had returned at that period from his circumnavigation of Australia with Phillip Parker King. Sieber worked very hard during the seven months in New South Wales, preparing excellent and extensive collections of plants which were labelled *Flor. Nov. Holl.* and *Pls. Exot.*

He left Sydney in December 1823 and sailed through the Pacific, past the Galapágos Islands and Cape Horn to the Cape of Good Hope, where on 8 April 1824 he again met Zeyher. He sailed again on the *Berwick* with his collection of Australian plants and Zeyher's collection of Cape plants, and arrived in London on 14 July 1824. This remarkable journey round the world was accomplished in less than two years and was a great achievement for that period. Sieber brought home to Europe a rich harvest of Australian plants (Maiden 1908; Weitenweber 1852).

After his return from Australia, Sieber went to Dresden in Saxony to work with Heinrich Gottlieb Ludwig Reichenbach (1793–1879). He formally described few species, leaving much of this work to Reichenbach and other experts of the day, including Endlicher, Kurt Polycarp Joachim Sprengel (1766–1833) and Augustin Pyramus de Candolle (1806–1893). Sieber's collection of the Proteaceae was described by Robert Brown in the Supplement to his *Prodromus* (Brown 1830). Dietrich's (1881) list of species gathered by Sieber incorrectly gives him as the authority of many of the plant names. This reflects Sieber's usage of manuscript names for species, names that were often adopted by the experts, e.g. *Eucalyptus pauciflora* Sieber ex Sprengel, *E. stellulata* Sieber ex DC.

Sieber's voyage and collecting in Australia, short as it was, was one of the last happy and successful periods in his life (Glückselig 1847). After that, he became increasingly mentally disturbed and was obsessed by the idea that he had invented a cure for rabies (Maiwald 1901, 1904). In 1830, Sieber advertised the sale of his 'herbaria, which were world wide, including New Holland, and contained 18,000 species. The price was low because money was needed for the publication of a treatise on rabies'. The herbarium sale was handled by the trading firm of Laemmel and Son, who had earlier sold part of his 'Botani-Bay' collection to the Kayserlichen Naturalien Cabinet in Vienna where Diesing (C.M. 1800–1862) was a curator. Sieber was finally committed to the Prague lunatic asylum on 15 December 1830, where he died fourteen years later on 17 December 1844.

The importance of Sieber's Australian visit, in spite of its short duration, is great. Being in New South Wales in spring and summer, he found large numbers of plants in flower, which he collected systematically and labelled well. By the distribution and sale of his herbaria the experts of his time were able to handle and make use of his labours in the distribution of plants among these many Australian examples.

Reichenbach (1825) wrote that Sieber returned with about 1,500 distinct species from New Holland and said the possibility to make so many discoveries in the New Holland Flora in such a short time without having government supported helpers can only be explained in his expertise, his industry and profound knowledge. Furthermore, Reichenbach said that Sieber travelled in the Blue Mountains where new roads had just been made and where no botanical foot had yet trodden, and hence so many new plants could be found.

Sieber, essentially a poor man, collected plants to make money, as it was customary to collect the 'green gold' to enrich the gardens and herbaria of the rich or Royal institutions. Fear of running out of money drove his feet, fear of others returning earlier to Europe with Australian plants made him return so soon. It was all his own enterprise. The poor devil had no support like Banks's collectors. The system under which Sieber worked was very much harder and more risky than that of the early French and English expeditions. These were supported by moneyed private persons, by royalty or directors of gardens. During the entire eighteenth and nineteenth century there were few collectors who risked the enterprise without support. The achievements of Sieber are quite remarkable; in spite of his short stay and limited financial resources, he brought back to Europe an important collection of Australian plants: algae, ferns and flowering plants.

Karl Alexander Anselm von Hügel (1795–1870)

The third visiting Austrian plant collector and botanist differed markedly from both Bauer and Sieber in his background, training and motivation. The Baron von Hügel arrived in the Swan River Colony in 1833.

Karl von Hügel, son of Johann Aloys Joseph Freiherr von Hügel and his wife Anna Susanna Phillipina Holdthoff was born 25 April 1795 in Regensburg on the Danube. His father was an Austrian diplomat and delegate to the German Reichstag at Regensburg personally appointed by the Austrian Emperor Franz (Wurzbach 1863). After the defeat of the Germans by Napoleon in 1805, the Reichstag and the Holy Roman Empire were disbanded and the von Hügel family moved permanently to Vienna. Here Karl was educated by private tutors until he entered Heidelberg University as a law student. In 1811 Karl (Fig. 2) joined the Austrian army fighting the war of independence against Napoleon and representing Austria on diplomatic missions at different courts in Europe. But, in 1824, von Hügel retired from his commission in the army and took up the study of natural sciences in Vienna.

Fig. 2. K. A. von Hügel, from a miniature on ivory by Moritz M. Daffinger, Vienna 1831. Portrait engraved on copper by Eaton.

After his father's death von Hügel lived in the family villa at Hietzing close to Schönbrunn, the Habsburg's summer residence near Vienna. Here he devoted his time and considerable means to the study of the natural sciences particularly botany and horticulture. This brought him in contact with the leading botanists at the University of Vienna. The chair was held by Joseph Franz von Jacquin (1766–1839), son of the former Professor N. J. von Jacquin. Dr S. L. Endlicher, first employed in the Royal Library, followed him in the chair. With all these he had successful discourse and learned a great deal of botany and horticulture from them and their institutions. His private means allowed him to extend his gardens and to employ very good gardeners. He corresponded with botanists all over the European continent and England and he organized an effective exchange of seeds and plants. He had connections with all famous botanists of this period and was respected by them. Prior to his travels to the southern continent, plants had been named for him, even Australian plants. *Huegelia* was a name given by H. G. L. Reichenbach to a plant from Rottnest Island, grown from seed in Europe. Now *Trachymene* Rudge, it was one of the first plants von Hügel recognized on his arrival in Fremantle. Also *Huegelia* R. Br. ex Endl., now *Decadianthe* Reichb., was named to honour him.

It must be noted at this point that by 1830 Australian plants were widely grown in European Botanic Gardens. The honeymoon with the American flora was over and Australian plants were the most desired ones. By 1822 twenty four Australian *Acacia* species and eighteen eucalypts were grown in the Botanic Gardens at Berlin (Link 1822). The gardens at Kew and the gardens of Malmaison and the Jardin des Plantes in Paris prided themselves with their Australian representatives. The gardens of the Habsburgs and their dependents were also growing rare Australian plants. So it was no wonder that von Hügel knew a large number of Australian plants on arrival in Western Australia, and later in New South Wales.

At the end of 1820s von Hügel's engagement to the Countess Melanie Zichy-Ferraris was announced. Von Hügel presented his bride-to-be at court where she was seen and immediately desired by the rich omnipotent Prince Metternich. As she was the daughter of a poor heavily indebted Hungarian nobleman, the parents made her give up von Hügel and marry Metternich on 30 January 1831.

Shortly before this date, broken-hearted von Hügel visited England and France to prepare for a six-year journey to India, Ceylon, Australasia, the Philippines, India and Kashmir. Through the intercession of the Emperor Franz, von Hügel was not only accepted as *persona grata* in these foreign parts but was also able to join HM frigate *Alligator* under the command of Captain Lambert for a cruise around Australia, New Zealand, the Philippines and back to India.

Karl von Hügel's travels in Australia are well documented through publications (Diels 1906; Hamersley 1981) and a diary which he started immediately on arrival. This was later edited and copied by an amanuensis in German script. This three volume, 2,000-page manuscript in three bound volumes was purchased in 1932 by the Mitchell Library in Sydney (K. von Hügel 1833–1836). The volumes describe not only all the people, the plants, the roads and everything he saw, but all he thought and felt. He was still longing for his lost sweetheart and had bouts of melancholy which are really sometimes most tedious to read in his massive diary. His romantic approach to life is a sign of the period, while his other observations in the diary are of great interest to us today. This is because they reflect a completely different approach to the well-known English observations. Australia is seen with different eyes. An English translation prepared by Ducker and Clark has been deposited in the Mitchell Library, Sydney and an extract prepared by Clark (1988).

In the Swan River Colony, including King Georges Sound, Karl von Hügel's visit lasted from 17 November 1833 to 12 January 1834. He spent from 20 January until 8 February 1834 in Tasmania. Following this, von Hügel had two sojourns in New South Wales separated by a visit to New Zealand of two months. On the return journey he spent three days on Norfolk Island, commenting on the penal system and not on botany. His extended visit to New South Wales was from 16 April until 6 October 1834.

The diary of von Hügel shows his great interest in natural science. In Western Australia, straight after arrival, he describes the sandy coastal vegetation at Fremantle (Napier 1975). A long plant list was enumerated and he was seemingly familiar with many of the local genera. Later, in November 1833, he compared it with the limestone vegetation on the banks of the Swan River. Here, and later in Tasmania and New South Wales, he sought out and was introduced to settlers who were helpful to him with plant identification (Hamersley 1981). At the Swan River Colony he met John Septimus Roe (1797–1878) and James Drummond (1784–1878). This was very fortunate and when *Prostanthera* was pointed out to him near Fremantle he eagerly collected seeds for his gardener at Hietzing. In Western Australia too, he received herbarium plants from the surgeon Alexander Collie (1793–1835). At Albany in January he was delighted

by the flora. Much was in flower in spite of the advanced season (Ducker 1984).

In Tasmania von Hügel's time was spent near Hobart Town; he ascended Mount Wellington on foot commenting on tree-ferns, which he saw for the first time (Webster 1988). The New South Wales section of the diary ends with a vegetation type survey of those parts of the country he had traversed. I think it is very interesting, since it is the earliest available classification of the landscape known to me from Australia and is based on soils, substrates and the accompanying vegetation.

In this diary von Hügel did not generally enumerate the plants which he encountered and only rarely did he write the specific names.

However, through the publication by Endlicher *et al.* (1837) of *Enumeratio plantarum Novae Hollandiae*, we have today a good record of his collecting in Western Australia. This volume lists all the plants which von Hügel brought back in his herbarium from the Swan River Colony. Many of these were new to science and have been described by the great botanists of his day together with Endlicher: Eduard Fenzl (1808–1878), George Bentham (1800–1884) and Heinrich Wilhelm Schott (1794–1865). The book also gives a short itinerary of his travels in that colony: arriving in Fremantle, he spent some time near the coast until he went to the Darlington Hills and then departed for King Georges Sound. Only plants from Western Australia are considered.

In 1838 Endlicher published *Stirpium australasicarum herbarii hügeliana decades tres* which described further plants from the von Hügel herbarium and contains taxa collected by both von Hügel and Roe. John Septimus Roe was a naval officer who became Surveyor-General of the newly formed settlement at Swan River. *Roea* Huegel ex Bentham remembers him and Steudel created *Hugelroea* to honour the two collectors.

Of the circa 350 new plants described from von Hügel's collections, the genera *Marianthus*, *Roea*, *Zichya* and *Macarthuria* commemorate personalities from his life. Bentham named the genus *Hardenbergia* after Franziska von Hardenberg, von Hügel's sister who married the Graf von Hardenberg. She also took care of the plants von Hügel had collected on his journeys. *Marianthus* Huegel ex Endlicher is named not only for his former betrothed, the Princess Marie von Metternich, but also because she was a patroness of botany in Austria. *Zichya mollis* Huegel also remembers her. *Macarthuria* Huegel ex Endlicher is named for William Macarthur (1800–1882), his host in New South Wales, who was a horticulturist, agriculturist and vigneron. Among the many plants, species of *Verticordia*, *Acacia*, *Mollinedia*, *Melaleuca*, *Stackhousia*, *Caladenia*, *Hardenbergia*, *Diplopeltis* and *Hibiscus* commemorate him by specific epithets. The two publications by Endlicher bear witness to von Hügel's interest in the Western Australian flora and his collecting zeal.

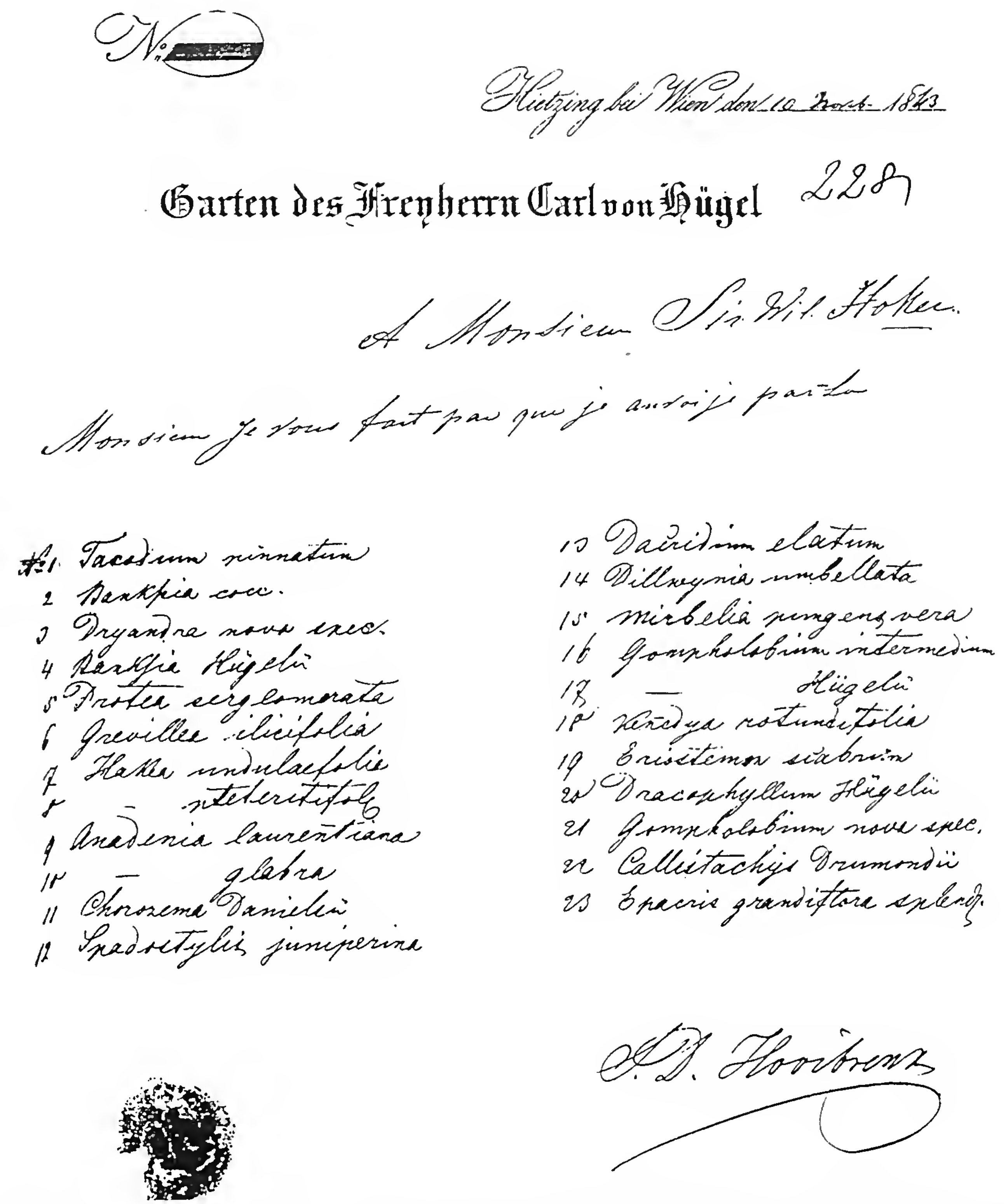
I am unaware of any plants collected by Karl von Hügel during his stay in Tasmania, New South Wales, New Zealand or Norfolk Island. But he acquired New Zealand herbarium plants from Richard Cunningham (1793–1835) on the instigation by Alexander Macleay, the Colonial Secretary, when they met as fellow passengers on board the *Alligator* returning from Norfolk Island (E. Webster, personal communication).

As well as the documentation of his observations in his diary, the travels of von Hügel are very important for Australian botanists for two other reasons; that is botanical publications, and the promotion of Australian plants in horticulture. Several publications resulted directly from his plant collections; the two by Endlicher and Endlicher *et al.* (1837, 1838) discussed earlier and von Hügel's own publication in the *Botanische Archiv der Gartenbaugesellschaft* (1837). In the latter publication the same plants as in Endlicher are given but they carry German descriptions aimed at garden lovers. These descriptions are accompanied by beautiful illustrations which have puzzled me for a long time. They bear the hallmark of the Jacquin-Bauer school, but are not of a comparable quality. After consultation with Dr H. W. Lack in Berlin, I believe that these are not by von Hügel himself, but by a professional illustrator employed by him. All illustrations are of plants which were growing in von Hügel's gardens at Hietzing.

Karl von Hügel promoted horticulture, with special emphasis on Australian plants, in continental Europe and also in England and Ireland. On his return from his travels in 1837 he founded the Austrian Horticultural Society, Die kaiserliche und königliche Gartenbaugesellschaft. This was modelled on the English Royal Horticultural Society. This was a plan that he had conceived in 1827 but which was delayed by his absence abroad. He was the first president of the society. The gardens of von Hügel rapidly attained a high reputation through their innumerable novelties. These plants had been brought home as plants, seeds and cuttings from India, Australasia and South Africa by the Baron. He and his gardeners entertained an active correspondence with botanists of the period. These were R. Brown, Bentham, the Hookers, F. Mueller and Endlicher (Letters at Kew, Fig. 4).

In the early years of his gardens and during the time of von Hügel's absence on his travels, Johann Heller (*fl.* 1838) officiated as the responsible gardener. In 1838 the Baron engaged Daniel Hooibrenk (1813–1863?), a Dutch gardener who had been trained in Holland and Paris. Hooibrenk, world famous for his gardening skill, was in charge of the von Hügel gardens from 1838 until 1849. It was Hooibrenk who purchased the major part of the von Hügel estate in 1849 and turned it into a famous market garden and plant nursery (Wurzbach 1858). He is important today for systematic botany through his correspondence with contemporary botanists relating to Australian plants grown and distributed from the von Hügel gardens, some of which were then used for additional material in plant descriptions. Part of a letter to W. J. Hooker is illustrated (Fig. 3). It contains a list of Australian plants grown in the von Hügel gardens and his signature. Today these gardens are swallowed up by suburbia and all that remains is a bust of Karl von Hügel erected in 1901 to commemorate the founder of the Austrian horticultural society (Ducker 1984).

After the Austrian revolution in 1848 Karl von Hügel never returned permanently to live in Vienna (A. von Hügel 1903) but lived as Ambassador in Flor-


No.

Hietzing bei Wien den 10 Nov. 1843

Garten des Freyherrn Carl von Hügel 228

A Monsieur Sir Wil. Hoker.

Monsieur Je vous fait par que je envoije par la

1 Taxodium pinnatum
2 Banksia cocc.
3 Dryandra nova spec.
4 Banksia Hügelii
5 Protea conglomerata
6 Grevillea ilicifolia
7 Hakea undulaefolia
8 — teretifol.
9 Anadenia laurentiana
10 — glabra
11 Chorozema Danielii
12 Spadostylis juniperina
13 Daviesia elatum
14 Dillwynia umbellata
15 Mirbelia pungens vera
16 Gompholobium intermedium
17 — Hügelii
18 Kennedya rotundifolia
19 Eriostemon scabrum
20 Dracophyllum Hügelii
21 Gompholobium nova spec.
22 Callistachys Drummondii
23 Epacris grandiflora splend.

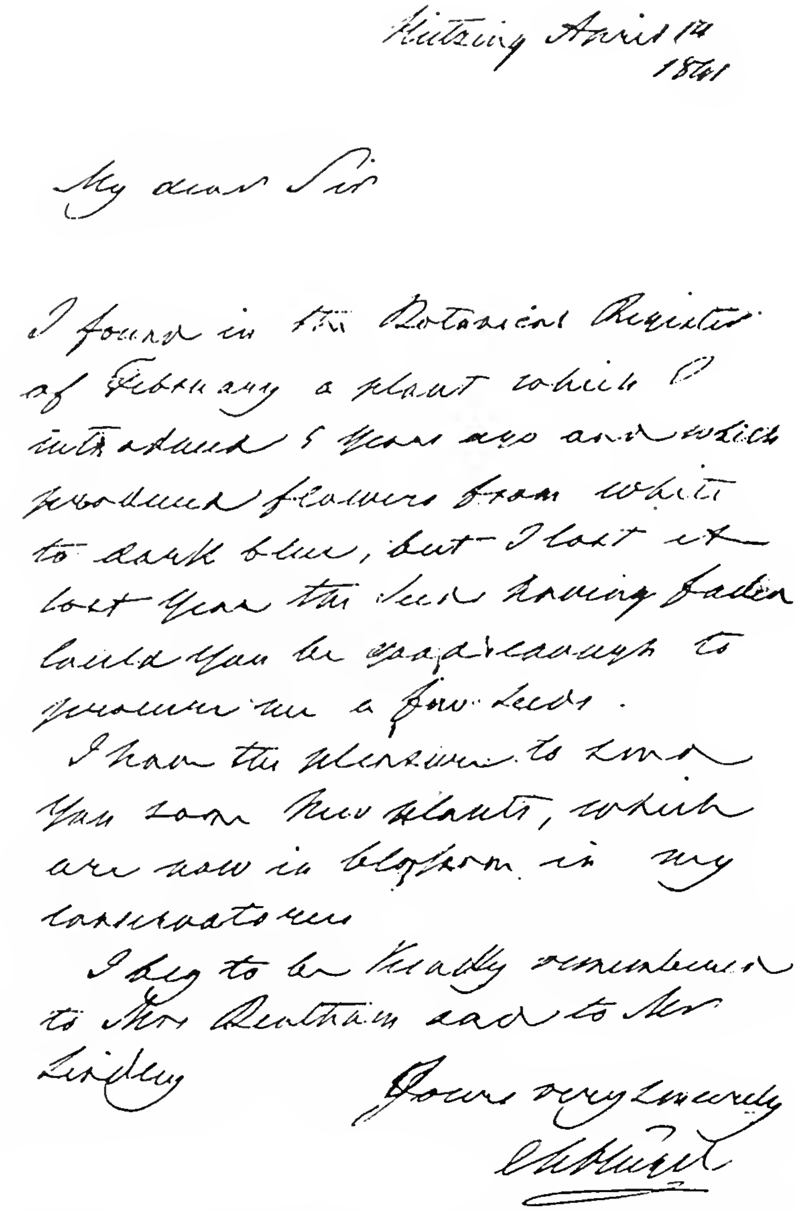
D. Hooibrenk

Fig. 3. Letter of D. Hooibrenk (10 November 1843) to Sir William Hooker. The heading is from the garden of the Freyherr Carl von Hügel, and the signature of D. Hooibrenk. Note the list of Australian plants; he is sending seeds to Kew gardens. (K, German Letters — copyright K).

ence and Brussels, where he died in 1870; he was buried in Vienna. In 1851 he had married Elizabeth Farquharson, daughter of a Scottish General. They had three children, the second son inherited the father's interests in natural history. Baron Anatole von Hügel came to Australia after succeeding to the title and, in 1874, made collections of birds while staying at Olinda in the Dandenong Ranges. He is sometimes confused with the father (Baines 1981).

In Vienna in 1847 von Hügel gave a lecture of special interest to Australians. It was to the Vienna friends of the Natural Sciences and dealt with recent explorations in central Australia. Comparing it with the well explored regions of Europe, he said that in New Holland only the coastal regions so far were known. Giving the story of explorations so far and naming Allan Cunningham, Sturt, Frome, Earl, Eyre, Oxley and Mitchell he discussed in this rare publication the Australian river system and the theory of a big inland sea. All this was in preparation in the talk about the achievements of Dr Leichhardt on his first journey to Port Essington and his preparation for the crossing of the continent and with all their best wishes for success.

Through his extended travels and publications on the Indian subcontinent (K. von Hügel 1840–1844;



Hitzing April 14
1841

My dear Sir

I found in the Botanical Register
of February a plant which I
introduced 5 years ago and which
produced flowers from white
to dark blue, but I lost it
last year the seed having faded
Could you be good enough to
procure me a few seeds.
I have the pleasure to send
You some new plants, which
are now in blossom in my
conservatories
I beg to be kindly remembered
to Mrs Bentham and to Mr
Lindley
Yours very sincerely
CHHügel

Fig. 4. Letter of C. H. Hügel (as he signed his English correspondence) to George Bentham including greetings to Mrs Bentham and Mr [John] Lindley dated April 1841. (K, Bentham Correspondence V — copyright K).

1850) and the Philippines (K. von Hügel 1860), Karl von Hügel received many awards and honours, among them an honorary degree of Oxford University and the Patron's Medal of the Royal Geographical Society of London for research in Kashmir and elsewhere (A. von Hügel 1903).

The three Austrian visitors to New Holland were indeed different. I frequently wonder how much they knew of each other. In the 1820s Vienna had about 250,000 inhabitants (Vancsa 1988); it is reasonable to assume that botanists knew each other, particularly as Endlicher published accounts of Australian plants for both Bauer and von Hügel. The affiliation of Sieber is somewhat different as he returned to Prague and then worked with Reichenbach in Dresden. But after his first spell in a hospital, believing that he was cured, he arrived with part of his Australian plant collections in Vienna in 1828 (Glückselig 1847).

All three Austrian travellers and collectors are mentioned by J. D. Hooker in the early history of Australian botany in the introductory essay to *Flora Tasmaniae* (1860). Ferdinand Bauer, Sieber and von Hügel created their own memorials by their labours on this continent. Their motivations varied but their legacies are part of our Australian botanical and artistic inheritance.

Acknowledgements

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Early art work as a source of botanical information in South Australia

D. E. Symon

C/- The Botanic Gardens of Adelaide and State Herbarium, North Terrace, Adelaide, South Australia 5000

The landscape painters, G. F. Angas, S. T. Gill and E. von Guérard, all worked in South Australia soon after establishment of the colony. The potential contribution of their early paintings and drawings to the record of original vegetation has been evaluated by comparing current landscapes with their published works, field sketches and originals housed in the Art Gallery of South Australia, the von Guérard sketchbook from the Alexander Turnbull Library, Wellington, New Zealand, and field sketches by Angas held in the National Library of Australia.

Samuel Thomas Gill

Born in 1818, Gill settled with his parents in South Australia in 1839, only three years after settlement of the colony. He was then 21 and had some training in art. In 1840 he advertised, soliciting patronage and offering a correct likeness of patrons, families, horses, dogs and local scenery. For 12 years he worked in South Australia, visiting and drawing many of the sites later used by Angas and von Guérard. He travelled extensively in the state and was a member of the Horrocks Expedition of 1846 which reached the lower Flinders Ranges. About 1851 he was insolvent and left for the Victorian goldfields where his most famous work was done (Appelyard *et al.* 1986).

A botanical controversy has existed over the original vegetation of the Burra hills. Gill did a series of paintings of the site from the opening of the mines in 1845. Three crucial paintings are *Burra Burra Mine 1845*, *Kooringa, the Burra Burra township 1847*, and *Patent Copper Company's smelting works and the Burra Burra Mine 1850.*

His pictures show a rapid and dramatic clearing of the original open woodland for the copper mines, housing and fuel. In a remarkably short space of time the hills are shown as bare as they are now.

George French Angas

Angas was born in 1822. After a brief period in the family business and an equally brief four months of art lessons he visited Malta and Sicily. His published rambles were illustrated with his sketches and lithographs. His father, George Fife Angas, was involved with the settlement of South Australia. George French Angus collected subscribers for *South Australia illustrated* (Angus 1847) before he left for the colony, where he arrived in 1844. Within days of his arrival he set off to the country doing drawings of the landscapes. In July he left for New Zealand to prepare *The New Zealanders illustrated* (Angus 1846) but he was back in Adelaide early in 1845. After further exploration and an exhibition of his works he left for England in July 1845 where he exhibited 300 of his Australasian paintings (Tregenza 1980).

Comparing the paintings with the present day landscapes, the Angas view of Angaston (*Angaston, evening*) shows relatively little change. In contrast, drastic clearing is evident in areas adjacent to Port Lincoln (*Port Lincoln from Winter's Hill, 1845*) and Victor Harbour (*Encounter Bay*). A current view over Adelaide down Waterfall Gully shows denser vegetation than exhibited in Angas's painting, *View from Mount Lofty*, of 1844.

Modification of field sketches for final work is evident in some of Angas's paintings. For example, in *Encampment of Native Women near Cape Jervis* in the Art Gallery of South Australia, the aborigines depicted are clothed but are naked in the field sketches (*Encounter Bay Women*, National Library of Australia). However, although landscapes were heightened for dramatic effect, his portrayal of trees and localities is generally accurate.

Eugene von Guérard

Von Guérard was born in Vienna in 1811. After travel and artistic experience in Europe he came to Australia in 1852. In 1855, then newly married, he spent a short time in South Australia. In a period of only a few weeks he visited a number of the sites already illustrated by Angas and Gill (Carroll & Tregenza 1986).

Von Guérard was an established artist and his intensely romantic landscapes were appreciated widely in Australia. His fine field sketches are less well known but these provide accurate detailed drawings of South Australian sites, most of which can be localized today. They remain an important record of landscapes which are now commonly degraded.

On 27 July 1855 von Guérard completed a return walk from Waterfall Gully in the foothills to the summit of Mt Lofty, a round trip of 6 km and involving a climb of nearly 500 metres. During the day he completed a remarkable series of detailed pencil drawings of the landscape and individual plant species. The fine detail and von Guérard's annotations have enabled all the sites to be localized and compared with the present scene. These studies, housed at the Alexander Turnbull Library, constitute an important botanical record. However, caution is required when interpreting the final painted landscapes which were completed in his studio. Von Guérard combined his field sketches into a final picture which was therefore contrived. The several elements combined in *Scenery in the Mount Lofty Ranges, near Adelaide, and a view of the Gulf of St. Vincent, South Australia* (Elders IXL Collection, Art

Gallery of South Australia) can be readily identified from the field sketches.

Early vegetation in the vicinity of Adelaide

All three of the above artists showed more park like vegetation in the vicinity of Adelaide than now occurs, e.g. *Glen Osmond Mine* (Gill 1845), *Falls of Glen Stuart* (Angas 1844, of Morialta Falls) and *First Creek, 1855* (von Guérard). This raises the question of whether the artists were in fact accurate or, whether the woodlands have since thickened. Despite visiting many of the sites used as subject matter by them it has only been possible to identify one living tree depicted in their illustrations, e.g. *Bei Tanunda Creek, 1855* (von Guérard). A few dead ones were also recognized, e.g. in *Tanunda Creek, Sud. Aust. 1855* (von Guérard). This suggests that, unless they were cut down, the turn-over of trees in these localities might be more rapid than often thought.

Conclusions

Studies of the work of these artists suggest that they recorded useful botanical information at the ecological and landscape level, but less often at the species level. It is also evident that field sketches and studies provide more reliable information than final lithographs or oil paintings in which modification may have occurred.

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Documenting botanical art collections in Australia

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Abstract

The Botanic Gardens of Adelaide and State Herbarium have a policy of collecting Australian botanical illustrations. Examples of artists represented in the collection are given. The progress of a survey intended to locate Australian botanical art collections and biographical details on the artists is described. The need for conservation of other forms of pictorial botanical material is stressed.

Rather than looking backward at a long and imperfectly known list of artists who have left us their works, (paintings which simultaneously, have scientific and artistic importance), I here look at improvements which I suggest we should be urgently making to the ways in which our botanical illustrations are curated and managed. These suggestions stress the need for our institutions to work more closely together, in this case, not only herbaria and botanic gardens, but university departments, art galleries, museums and libraries. The problems of curation of botanical illustrations are truly interdisciplinary, truly exciting.

The advent of colour photography and technical improvements in equipment and printing processes have made a significant impact on how plants are illustrated in publications. For the purpose of this paper I shall not cover the issues of colour transparency collections, their storage, documentation and longevity, although they pose serious curatorial problems. There was once, about 30 years ago, an opinion held, that colour photography would replace traditionally executed botanical illustrations. But this has not come about, partly because of the intrinsic limitations of photography. No camera lens has yet been designed which can interpret the botanical subject like the human eye. The other main factor has been renewed interest in botanical illustrations since the late 1960s as may be seen from the number of books published on the subject since the classic work by Blunt (1950) and as may be seen in the final completion of *Banks's florilegum* some 200 years after Banks initiated the project (Steven 1988).

My own interest in botanical art goes back more than 20 years while working with botanical artists, Mary Grierson and Barbara Everard, on a popular book (Morley & Everard 1970), and a little later studying the works of Leonardo da Vinci (Morley 1979). Barbara had received her training more than 40 years earlier as one of a team of painters producing hand-painted wallpaper. This practical training enabled Barbara to very rapidly and dramatically cover large areas of paper with paint, either as a wash, or with a curious, almost impasto, use of watercolour. Barbara was not a trained botanist, but still discovered features which the botanist sometimes overlooked. She also had a splendid willingness to commit outrage as we jointly designed each plate in the book based on the species I wished to feature; to challenge the colour printer's patience with the plate of the Apocynaceae of South America; plunder the Wisley *Rhododendron* collection for the plate of the Ericaceae of China and the Himalayas. The frontispiece of the book, featuring the splendid orchid *Renanthera coccinea*, shows Barbara's bold and exuberant wallpaper-style. There is a need to record such biographical detail of living artists for posterity; so much is often lost.

There are many artists who, like Barbara Everard, have painted Australian native plant species but have never visited the continent. Some of the earliest botanical illustrations of Australian plants were done by European artists using cultivated specimens grown in Europe by enthusiastic horticulturists, the specimens sometimes being unrepresentative of the species concerned; a topic elaborated by Charles Nelson (this volume). A number of illustrations were done by artists belonging to the early European expeditions, artists such as Sydney Parkinson (Carr 1983) and Ferdinand Bauer (Stearn 1976). There is a very large number of botanical illustrations featuring Australian plant material scattered throughout the collections of European institutions. Carrick Chambers told me in 1978 that Mrs Julie Marginson was making a preliminary survey of the works in London in 1977 with a view to publishing the results. But what of the botanical illustrations now in Australia which have been produced in Australia by Australians since first settlement? Who has recorded biographical details and anecdotes about these artists, living and deceased? Where are examples of these works to be found, and in what condition are they being kept?

I would like to be able to tell you where particular botanical artists are represented in the collections of particular institutions on a state by state basis. However, apart from one or two exceptions, such as the Mitchell Library holdings, there is no national catalogue which can be given. We all have useful bits of information; I know of the Margaret Stones collection in the Queen Victoria Museum and Art Gallery in Launceston; many know of those in the National Gallery of Victoria and others in the Melbourne University Gallery and Art Collection acquired through the 'basalt plains flora' project and through the Grimwade Bequests. Other collections are in the Botany Department of the University of Western Australia,

Nedlands; the Waite Agricultural Research Institute; Adelaide Botanic Garden; and so on. This is clearly an unsatisfactory situation. Which institutions and individuals are continuing to act as commissioning agents for living botanical illustrators and according to what guidelines; is it a matter of policy or personal whim? The late Lord Talbot de Malahide and the Hon. Rose Talbot, his sister, were responsible for commissioning one of the most recent local major botanical art projects on the endemic flora of Tasmania, but they were and are remarkable people.

It is probably fair to distinguish two sorts of botanical art as David Symon (Woore *et al.* 1988) has pointed out — 'flower paintings' such as the work of Ellis Rowan having an emphasis towards ornamental high art; and botanical drawings, such as the work of Margaret Stones and Celia Rosser, who are amongst the greatest living Australian botanical artists, and produce scientifically accurate depictions of plants. There is no clear distinction between the two categories, or the types of media used. However, pen and ink, pencil, and watercolour are the most commonly employed.

Relatively few botanical artists have made a full-time living from this type of work and this accounts for the large quantity of illustrations which exist having been executed in leisure time or, as we might today describe them, by weekend artists. In the nineteenth century flower painting was a favourite past time of many women. Of the Victorian flower paintings which have survived many lack scientific accuracy or scientific interest, often being based on commonly cultivated garden plants of the period, but many also have great charm, sometimes feature old garden cultivars and deserve to be properly catalogued and curated for posterity. They occur as single paintings or in volumes, often bound in non-acid free papers and boards which pose a curatorial nightmare.

In 1978 David Sless, a colleague then lecturing at the Flinders University of South Australia, and I made a brief survey of an assortment of Australian institutions (art galleries, libraries, botanic gardens, university departments) likely to house botanical illustrations. It soon became apparent that 'botanical illustrations' as a category either failed to feature in the curatorial policy of institutions, or existed only for their curiosity value or antiquarian novelty. Sometimes the works represented the forgotten leftovers of the artwork prepared for a publication, or a collection of somewhat embarrassing paintings left in the will of the deceased artist, or by the artist's family. There were several institutions in the survey which had a policy for collecting botanical illustrations, but they were in a minority; I'm delighted to report they included the University of Melbourne Gallery and Art Collection!

It became clear to Sless and me a decade ago that greater coordination needed to exist between a range of different science and arts institutions sharing a rich heritage of botanical illustrations. The Hunt Institute for Botanical Documentation, Pittsburgh, has produced a series of valuable catalogues listing biographical details of the artists represented in their botanical illustration collections with one or two illustrations of the work of the artists (Lawrence 1968, Korach 1972, Secrist & Howard 1977, White & Wendel 1983). A similar national catalogue, or catalogues, for Australia would be a useful project. Compilation work is at present being undertaken in Adelaide towards this sort of end. Mrs Phyll McKillup, an M.A. student from the Flinders University of South Australia, is preparing a thesis examining how the visualization of biological organisms by artists has changed through the centuries; part of her project includes an overview of Australian botanical illustration since colonization.

Encouraging and directing the enquiries of students is only one way of helping promote a better understanding of Australian botanical illustrations. Even small institutions can make a contribution. In the Botanic Gardens of Adelaide and State Herbarium a policy has been adopted to collect and curate examples of botanical illustration primarily by Australian artists. Although only about ten years old, the policy has resulted in a spectacular growth of the collection. The South Australian Museum has transferred its rich collection of Ellis Rowan (Hazzard 1984) and Alison Ashby paintings in recognition of this new curatorial policy. New illustrations for the collection have been purchased and commissioned by the Botanic Gardens Board and Friends. A specialized gallery to display periodically the holdings has been created to acceptable professional display standards. Several successful exhibitions featuring old and new botanical illustrations have been held, the most recent being in the 1988 Adelaide Arts Festival featuring Ellis Rowan (Woore et al. 1988). The collections are being catalogued with voluntary help and are being professionally conserved with funds from sponsorship in the absence of Government resources.

There is much improved awareness of the significance of botanical illustrations amongst the Friends and community at large. Several local commercial galleries, such as Bonython Meadmore Gallery, have for the first time held exhibitions of botanical illustration which is significant bearing in mind the smaller clientele of Adelaide compared with Sydney or Melbourne.

A foundation has been created based on sales of Alison Ashby products featuring her native plant paintings (Ling 1981). At present the products are postcards, greeting cards, notelets and a Christmas card. The Alison Ashby Foundation is intended to fund research and a better understanding and utilization of native plants in gardens, but is based on the power of the botanical illustration.

Our Friends commissioned local artist Jan Woodman to design and paint the commercially successful posters featuring the wildflowers of the Mount Lofty Ranges and Flinders Ranges. The originals are part of the collection. As a direct result, an anonymous donor sponsored Jan Woodman to receive improved botanical training in the Botanic Gardens and State Herbarium. Thus, the institutional policy to promote botanical illustration is already materially helping the artist in the community and enriching the community experience through regular, carefully planned exhibitions.

It would be fitting if this symposium, held in Australia's bicentennial year, could mark the beginning of a coordinated move to give consideration to preparing a national catalogue of the botanical illustrations in public institutions in Australia. Perhaps coordinated

on a state basis by selected centres in each state, it might receive funding through a federal source. It would doubtless be a substantial project. There is certainly a need, for at present I believe we have only fragmentary and scattered records of the work of botanical artists held in Australian institutions. Sampson (1985) has made a useful contribution to documenting early botanical art in New Zealand in the period of James Cook to T. F. Cheeseman's *Manual of the New Zealand Flora*. The focus of attention of this neglected form of art could also help improve the conditions under which much of it is presently stored.

The publication programme of my own organization has a component which seeks to feature the work of lesser known botanical artists wherever possible. In this way the crayon work of Collin Woolcock was used in the fourth edition of the *Flora of South Australia* as well as line drawings of a variety of other artists, also regularly featured in our house journal. Commercial publishers have used some of our paintings in joint venture publications (Lothian 1974), or have commissioned artists to prepare illustrations for books (Morley & Toelken 1983), artwork subsequently being added to the collection.

Summary

* It is suggested that a coordinated, national programme is required to survey and document the botanical illustrations held in public collections, and where sufficiently large, in private collections also. A range of scientific and arts institutions may be mutually involved.
* Experience in South Australia demonstrates significant public benefit from active promotion of botanical art. Artists, sponsors and donors all benefit. Better exhibition facilities, improved curatorial standards, as well as base documentation of holdings are results of improved awareness. There is an enrichment of the quality of life of the general community.
* A diversity of educational and commercial opportunities can flow from active promotion of botanical art in any institution visited by the public.
* It is as important to provide opportunity and patronage for botanical artists today, as to curate our heritage of botanical art from the past.

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Building a bibliography: some difficulties, with special reference to *Taxonomic literature*, ed. 2

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Abstract

It is rare that users of bibliographies consider the reasons that led their authors to write them in the first place. The second edition of *Taxonomic literature* (TL-2), as the most comprehensive guide to the publications of taxonomic botany and to biographical references concerning their authors, is no exception. It can be shown that it came about as the culmination of the establishment of the International Association for Plant Taxonomy (IAPT) and the various projects it generated over the first nearly 40 years of its existence. For the conception of the IAPT and TL-2, however, one must return to the first quarter of this century when H. N. Hall and A. S. Hitchcock jointly began to develop pressure for an International Bureau of Plant Taxonomy which would do all the things the IAPT has, in fact, accomplished.

With any bibliographic or historical undertaking, one must initially clearly define the ultimate purpose and audience for the completed work. The location of data to be included is nearly as difficult as choosing what to include and developing an efficient system for recording and ordering information is still another important consideration. All these suggested difficulties were compounded in TL-2 by the time frame of the work (1753 through 1939), by its scope (all groups of plants, fossil and Recent) and initially by the lack of credibility of the community for the project.

Despite the fact that I see myself more as a user of bibliographies and historical works than a producer, I have been asked to talk about some of the difficulties in locating, gaining access to, and recording historical and bibliographical data, with special reference to TL-2, the second edition of *Taxonomic literature* (Stafleu & Cowan 1976–1988), the seventh and last volume of which was published 3 March. But I would like to spend just a moment in these introductory words to ask why anyone writes bibliographies, for I think most of us just use them without giving a second thought to why they are undertaken in the first place. Then I will say something about why TL-2 was written.

One group of bibliographers we can identify easily: just as there are compulsive indexers, there are those who seem to derive great personal satisfaction from constructing bibliographies, and we bless them, whatever their motive. Many taxonomists, at least, build their own bibliographic tools because none exist and they are needed for their own research. Then there are those who have a deep interest in the historical development of an author or subject area. To some extent TL-2 partakes of all these reasons in a manifestly incomplete listing: we undertook what we thought was a three-volume, five year project because we sincerely believed that it was needed by all areas of systematic botany and at least I was of the opinion that Stafleu was, and is, one of the few people, perhaps the only person, in this period of botanical history who could write such a work and was willing to do so. In his preface to the seventh volume, Stafleu explains that we were able to make the book more comprehensive, seven volumes instead of three, because we were both willing to devote essentially all our research time for several years to the project.

TL-2 came about as a logical outgrowth of, indeed was only possible because of, various activities of the International Association of Plant Taxonomists (IAPT) that were presaged as early as the first proposals for an International Bureau for Plant Taxonomy, especially by H. M. Hall and A. S. Hitchcock. Just as Darwin had encouraged J. D. Hooker and Kew to undertake the *Index kewensis* because of the need he experienced in his own work, Hall and Hitchcock attempted as early as 1930 to sell the idea of an International Bureau to meet special problems they encountered. It was not until at the 1950 Stockholm Congress, however, that the IAPT was initiated. Work with the *International code of botanical nomenclature* (Greuter *et al.* 1988), the *Index nominum genericorum* (Farr *et al.* 1979), the *Index herbariorum*, parts I and II (Holmgren *et al.* 1981; Lanjouw et al. 1954-x), as well as, and in particular, TL-1 (Stafleu 1967), all brought together the kind of data required to undertake a TL-2.

Few accomplishments are made without personal commitments, personal motivations. In the case of TL-1, it was Stafleu, harkening to the urging of Grady Webster (University of California, Davis) who made available the contents of the card file on his desk. The personal context for TL-2 was completely different, for it grew out of conversations in 1974, concerning what we would do with the rest of our lives. I had already put down my administrative responsibilities and Stafleu was ready to follow suit with his; we concluded that a second edition of *Taxonomic literature* would be easily

the best use of the next several years, both from the stand-point of personal satisfaction and of service to the botanical community. I had no expectation at that time of being involved and neither of us had even a vague notion at the beginning that it would take 14 years and seven volumes to do the job right.

Locating data

Locating bibliographic/historical data requires, first of all, decisions concerning what data are wanted, which would have seemed to be a simple task for TL-2; in the first edition it was extremely simple, for it consisted of Stafleu deciding that the contents of his card file that had accrued from his own taxonomic work, as well as that with H. W. Rickett on the *Code*, would be the basis of that very helpful book. It treated primarily books in the usual sense of the word but in TL-2, sometime around volume two or three, we realized that we were omitting many very important works for taxonomy by ignoring journal publications. To have attempted to include all of them was patently absurd. There were at least two classes of such publications we did include from about volume three onward: (1) papers published in parts, often in different journals, and (2) reprints or preprints with independent pagination. Having opened Pandora's box, the number of journal articles included was determined in the end largely by those we came across, although we tried to sort out and include the more significant ones, leaving the dross for the TL-2 files.

The *Catalogue of scientific papers* (1867–1925) lists most 18th century publications of this sort but the single most important source of such titles for TL-2 was the reprint collection at the Conservatoire botanique in Geneva. Many hundreds of bound volumes of catalogued reprints and preprints from authors around the world form an unexcelled bibliographic resource that should not be overlooked when searching for titles otherwise unavailable.

For botanical books there are a number of well-known sources which list in one form or another many of the publications that have appeared over the last couple of hundred years, such as Pritzel's *Thesaurus literaturae botanicae* (1847–1852), B. D. Jackson's *Guide to the literature of botany* (1881), the catalogue of the British Museum (Natural History) library, the *Bibliographie de la France* (1813-x), and Australian sources such as Nancy Burbidge's *Australian botanical literature* (1978), the catalogues of the Mitchell Library in Sydney, the State Library in Melbourne, and the University of Western Australia and Alexander Libraries in Perth. It is interesting, indeed surprising for me at least, that even when one puts all these, and still others together, there are still many works that escaped inclusion in the standard bibliographies. Initially, we drew up lists of authors and their publications, taken from Pritzel, Jackson and the rest; we took these lists when we went to our key libraries so that we could find the books and collect data on them. Then we realized from working at the super-rich U.S. Dept. of Agriculture (USDA) library in suburban Washington, following these lists of authors and their works, that for every book on the list there were several times as many on the shelves that had not appeared in the earlier bibliographies but which were equally valuable! It was like finding nuggets among the grains and flakes of gold at the bottom of the washing pan! Now the USDA library is 14 storeys high; ten of the floors are devoted to actual library shelving and about two or three of them are filled with shelves of publications of conceivable importance to taxonomic botany. I ended by spending a couple of hours every evening for the next several years in the library, after hours, with all facilities available for recording data, taking down every book from the shelf and looking at it long enough to decide whether it was potentially useful for plant taxonomists, worth capturing its data. We discovered that such unrecorded works are to be found in every botanical library of reasonable age and size. Later, for example, much later than we would have liked, we started using the State Library in Berlin (Pritzel's home base), which is a Mother Lode of such literature and we did all we could with the publications of authors in the latter, perhaps one-third of the alphabet. So the first difficulty in preparing such a bibliography is knowing that a particular work even exists.

By way of summary of this point then, we began with cumulative lists of authors and their works, derived from card files of the entries in Pritzel (1847–1852), Jackson (1881), and all the rest, photocopied page by page and the entries cut apart to be glued to individual cards. To this we added what we found in the shelf — by shelf search of libraries at Brussels, Geneva, Utrecht, Washington, St Louis, New York, Cambridge (U.S.A) and Philadelphia, to which were added the multitude of items called to our attention by volunteer collaborators at Chicago, Pittsburgh, Berkeley, Lund, Göteborg, Helsinki, Munich, Florence, Göttingen, and Berlin. A full listing of libraries and of collaborators will be found in the epilogue in volume seven. One might think that TL-2 is meant to be a bibliography to end the need for further ones but everyone here probably knows that it is not complete and in fact, as the subtitle indicates, it is intended as a selective guide rather than the last word. I can tell you that my phycological spouse complains that there are many missing works on algae and our young two-year old is totally unimpressed with TL-2 because of the lack of pictures! (Everyone's a critic these days!)

Accessibility and recording of library resources

Reactions, mostly on the part of librarians, to our need to gain access to the works we wished to include ranged from apathy to enthusiasm, depending on their vision and potential involvement. The whole idea of building a bibliography for all groups of plants, fossil and Recent, from 1753 through 1939 was a bit staggering, so much so that initially we had difficulty convincing anyone, especially the grant-giving agencies, that we were not embarked on an impossible journey. For that reason we pushed along the first volume as rapidly as thoroughness and accuracy permitted, to have a sample of what we intended to finish, in order to convince everyone of the seriousness of the project. I am going into these details because I believe they have a lot to do with gaining access to library resources. Once volume one had appeared attitudes began to change and, by the latter stages, the U.S. National Science Foundation was willing, perhaps it is not too strong to say eager, to provide the resources that would ensure completion of the work.

I referred earlier to the U.S. Dept. of Agriculture library: there was certainly no difficulty of access because it is an open, taxpayers' institution but I was fortunate to get the ear of one of the administrators to point out how much we needed to do there in the way of data capture and she understood. Especially she understood that if their staff had to service my requests for help they would get little else done but, if they gave me free access to the shelves and to all the equipment, their cooperation would cost them very little indeed. From the beginning the libraries of the New York Botanical Garden and the Missouri Botanical Garden were freely available along with all the staff support we required. In Europe there are many outstanding botanical libraries and we had the full support of those at Berlin, Brussels, Munich, and Geneva, but some of the more obvious ones, like those in London and Paris were more difficult, for different reasons I must explain by sketching our methods for recording data.

Although Pritzel captured data for the *Thesaurus literaturae botanicae* in handwriting on cards, it is clear that TL-2 would not have been possible without access to photocopying equipment and where it was not available we simply did not try to work. Basically, we photocopied the title page and other pages that would enable us to date the book, at least approximately, and then wrote bibliographic details in stable inks on the title-page photocopy, such obvious details as pagination, plates, format, as well as less obvious ones, name of the illustrators, how the plates were made, and of course the abbreviation for the institution responsible for the library. This may not be a perfect data-collection scheme but it works and moreover, sources for TL-2 data can be rechecked when necessary, because these sheets were intended to be a long-time, if not permanent, record, of the data used. I'll say a bit more about these files at the end of my remarks.

I have to say that we didn't attempt to work in the Paris libraries and we gave up working at the BM and at Kew because of the difficulties of obtaining photocopies on the spot for our system of operation. For obvious reasons, but mainly the lack of freely available copying equipment, we also didn't attempt to work at either Moscow or Leningrad which would have been very rewarding I am sure. We ended the project with perhaps two million sheets of A4 and/or A3 paper; while I have not checked the accuracy of the computations, Stanley Greene, the British bryologist and frequent user of TL-2 files, estimated some time ago that if one piled the sheets atop one another, the top of the stack would just reach the level of Stafleu's 19th storey office!

Another difficulty of access to such data which one may encounter but which can be overcome is that of access to the contents of private libraries or libraries which are not ordinarily open to the public. The John Crerar Library in the Chicago area was a good example of a very rich collection which could be used only by people in the area with permission and requests for assistance by mail simply were not answered. We got around that problem by enlisting the assistance of John Engle at the Field Museum to search out particularly rare items that we knew were there from the listing in the catalogue of the National Library of Congress. Parenthetically, I could mention difficulty of access to Rare Book Libraries in general because they are often guarded by dedicated men and women who do their best to keep potential users at bay; to deal with this particular impediment, I leave you to your own devices! I doubt that either Stafleu or I will ever forget the Rare Book Librarian at a university in the U.S.A. who accused Stafleu of 'throwing books around' after one volume had slid off another on the work table!! The Hunt Library of the Carnegie University in Pittsburgh is another, quite different, example of a private library. It is a rich, personal collection that was given by Rachel Masters Hunt to a public institution where scholars are welcomed to use it and any reasonable request for assistance is filled promptly. Then there is the Library of Congress: there is a good example of a library where working in the stacks, which we had to do if we were to finish the job in our lifetimes, was possible largely by using our wits to circumvent the antiquated, cumbersome bureaucracy that characterizes that institution. It is such a vast collection in so many separate buildings and annexes that one needs first to be a geographer to avoid being hopelessly lost in the miles of stacks. Still another kind of private library are those of botanist friends and associates who in all cases were enormously helpful in every way; for example Paul Silva's algological library, Joseph Ewan's library of early Americana, William Steere's bryological library, John Stevenson's mycological library at the National Fungus Collections in suburban Washington D.C. and John Wurdack's private library of Latin American travel and exploration books.

Biographical face of TL-2

At this point I have said something about how one may go about building a bibliography, what to record and one method of recording it, and difficulties of access, but I now turn to the other face of TL-2, the biographical one, for one comes to understand, in various ways, the literature of the authors included when something is known about them. Their birth/death dates help to identify the author; their education and regular occupation often reveals or suggests insights into their publications. Sometimes one does not have to look far for information about some 19th century authors, for in very small print under the author's name on a title-page often appears all the honorary and real titles the author claims, and the list can get quite lengthy. One may even conclude that modesty was not then an altogether cherished personal trait, but one French author whose book we were looking at in the Geneva library for possible inclusion really seemed to be 'taking the micky' out on his colleagues — I apologize for not having a photocopy of that title page because then I could verify this tale. Following his name on the title page, in very small print, he explains, in paraphrase as I remember it, that he is neither director nor has he ever been director of any botanical garden or other botanical establishment, he is Fellow of no learned societies, he has as patrons no great names, he has been awarded no national or international prizes for his botanical work. No, he has none of these claims to fame, the only thing he can claim is a love of plants and of botany!

There are a great many sources of information about people in all fields of science but if the other areas are

anything like botany, you will look very hard indeed for details about the lives of women practitioners of the science. You very often can discover whom they married, especially if the spouse happens to be a botanist of note. If you look through TL-2, you will see that our data are often incomplete on women botanists, even on their birth and death.

You will recognize the titles of such well-known biographical sources as Ray Desmond's *Dictionary of British and Irish botanists and horticulturists* (1977), the *Dictionary of national biography* (Stephen & Lee 1885–1900), *American men and women of science* (Jacques Cattell Press, New York), the various *Who's Who* and the *Australian dictionary of biography* (Shaw & Clark 1966-x). They need only be mentioned in passing but there are so many more when you are working internationally, such as John Barnhart's *Biographical notes upon botanists* (1965), the *Dictionnaire de biographie francaise* (1813-x), *Flora malesiana*, *Flora brasiliensis* (Martius 1906), Laseguc's *Musee botanique de M. Benjamin Delessert* (1845), Lipschitz's *Botanicorum rossicorum lexicon biographo-bibliographicum* (1947–1951) in four volumes, M. Moebius's *Geschichte der botanik* (1937), Poggendorf's *Biographisch-literarisches handwörterbuch* (1965-x) and Zander's *Handwörterbuch der pflanzennamen* (1984), just to name a few of the ones we used for TL-2.

Still another source of such biographical data are the botanical journals, especially those before this century where every issue contained detailed notes on the travels and plans of botanists, honours bestowed, and their inevitable death notices. In journals one also finds such gems as those by J. H. Maiden in which he gave biographical notes on a great many of Australia's botanists to that time. To capture this information we went through many journals from their beginning, often to their demise, photocopying pages of news and notes, sometimes ten copies of a page if there were ten botanists mentioned, so that one copy could be filed under each of the ten names. For example I went through 141 volumes of *Botanisches centralblatt* for both biographic and bibliographic data, but there was also *Mycologia*, *Bulletin de la Société botanique de France*, *Botanische Zeitung*, *Flora*, *Grevillea*, *Bonplandia*, *Candollea* and many more. In some ways the biographic data were as interesting as the publications, superficially anyhow, and they constitute a unique characteristic of TL-2. Most of you in using the book will know that the first paragraph of an author's entry is a short diagnosis, as we called it, giving the most salient points about the author, followed by a list of references to further biographical information, each of which usually lead to still other references. So these paragraphs are a rich source for those who would do biographical studies in depth.

Herbaria and types

Another sort of problem we all use TL-2 to solve is where the herbarium and types of included authors are located and such information is often very difficult to locate. We are all familiar with sources such as Kent's *British herbaria* (1957), Clokie's *An account of herbaria at the University of Oxford* (1964), and part two of *Index herbariorum* — the IAPT *Collectors index* (Lanjouw *et al.* 1954–1988), the writing of which, incidentally, is now completed. Another very interesting source, not always something that immediately comes to mind is Lasegue's (1845) book on the collections in the Museum of Benjamin Delessert. Journal notices of the death of a botanist not infrequently gave information concerning the fate of his collection and/or types. When the IAPT collected information on holdings of herbaria for the first edition of *Index herbariorum*, enormous numbers of data on the location of herbaria came together, much of it for the first time.

Abbreviations of book titles

I will leave you with one last story which has to do with the abbreviations of short titles of books which I am pleased to see are being used even though the author abbreviations have been pretty well ignored. We arrived at the abbreviations of book titles in the deliberations of a small committee of four that met as needed and when a volume was due to be completed, it was often daily for several weeks. In the course of working on volume one the committee spent endless time on ground rules which changed by the day; every name was a debating contest! Finally in exasperation, when we arrived at the entry for Bastard, I wrote in the margin of the proof that the committee suggested it be cited as S.O.B. We laughed and went on but when the volume appeared there is a note by the senior author 'The abbreviation S.O.B. for the name of this author would be wholly undeserved.' The real kicker comes in the index to names where our colleague at Utrecht who did those indexes lists 'S.O.B. *v.* Bastard, T.' There are not many light moments in TL-2, only one plate but, regrettably, errors of both omission and commission.

TL-2 files

I spoke earlier of the TL-2 files being permanent, by which I mean that the about two million pieces of paper, all our notes etc. constitute a unique biographic and bibliographic resource that will be curated by the New York Botanical Garden and made available to researchers. It should be noted that there are many times as many data in that file as there are in the seven volumes. I say this because a photocopy of a 30-page biography of an author may appear in TL-2 as half a line or less, just a reference to the existence of the biography. And we collected data on many more authors than appear in the work, at least partly because we collected data on all authors, A to Z, from the beginning and information about authors in the A-G volume continued to accumulate while we were working on the W-Z volume at the end.

This may be as good a place as any to answer a few questions frequently asked by colleagues and which perhaps some of you may have wondered at as well. We are often asked how does one organize such enormous numbers of data from so many sources in a way they can be retrieved easily. I showed you earlier the photocopy of the annotated title page of one volume of the *Flora U.S.S.R.* (Komarov *et al.* 1934–1960) as an example of our data-gathering methods for books. These annotated photocopies with the surname of the author(s) highlighted were sorted on author's name, alphabetically, just as the book is organized. All the alphabetized secondary references on hundreds of thousands of photocopy sheets were arranged in the

last stages, just before the treatment of an author was written, in the order of the paragraphs in the book: the author diagnosis, data on the subject's herbaria and types, biographical references, eponomy and finally the books and papers produced by the author which have possible use to taxonomists. This order will be preserved in the TL-2 files at New York so that workers can readily identify the source of statements in the text, as well as exhume countless data that failed the TL-2 tests for inclusion.

Electronic Technology

Electronic technology has played a definite role in the completion of the job in what would have been otherwise a much more laborious task, as explained in the introduction to volume four. The first three volumes were produced from typewritten manuscript but already by volume two, the technology had improved and an early phototype composer was used for volume two and a laser-composer for volume three. With the cooperation and support of the printers who supplied what was then a very sophisticated word processing array, we began with volume four, in effect, to set type ourselves because the magnetic disks prepared by the typist drove the laser-scanner at the printers to produce the printed output. It was this 'proof' that was compared a character at a time with the handwritten manuscript for errors; corrections were made on the disk and the book was ready for final printing, thereby enabling us to have a volume published about every two years.

So often we are asked about a TL-2 supplement or a TL-3 that I must say something briefly on these matters. The short answer is that the authors of TL-2 will not add to that work in any way but we encourage any who will to send corrections to the Library of the New York Botanical Garden. At one time, much earlier, we had planned to bring out a reworking of volume one, whose coverage was about one-third as complete as the later volumes, as a kind of supplement but we soon realized that was not practical in our lifetimes. As we drew closer to the conclusion of TL-2, I have dared dream that younger hands would convert the contents of TL-2 to an electronic data base which could then be supplemented, corrected and maintained indefinitely as an international resource that would be addressed by satellite, just as we dial telephone numbers around the world from our desk even now. After the first period of data-base building when a substantial infusion of funds would be required, one would have to find a stable institutional base and a commitment to the regular fiscal support that would be needed for maintaining the file. In my opinion there will never be a TL-3 of any other sort.

Division of labour

One final question that is asked is the division of labour between the authors. Nearly all the writing was done by Stafleu, for he is the bibliographer, the historian. We both worked at the collection of data but the many tasks to see each volume through the press were his. My contribution was primarily data collection and organization but I also did most of the analyses of multi-volume works such as the *Pflanzenfamilien* (Engler & Prantl 1887–1915) and the *Flora U.S.S.R.* (Komarov *et al.* 1934–1960). I also did all the detailed proof-reading and I can tell you that the end of that task on 3 August 1987 was nearly as exciting as the publication of the last volume! We know that neither of us could have done the job without the other, for quite different reasons, so it was truly a collaborative project in the fullest sense of the word. I have mentioned a number of collaborators in Europe and the U.S principally but we should not forget the several assistants provided by research grants from the U.S. and Dutch governments, as well as the support of our home institutions, the Smithsonian Institution and the University of Utrecht.

It has been a long, often arduous road to the end of this task but we are continually rewarded by comments in letters, and directly, on the usefulness of the work, so we can look back on 14 years of its production with feelings of accomplishment. The last volume appeared 3 March and the index to titles volume will appear in the near future. Statistics in the last volume indicate that we consulted 101 libraries in presenting a total of 16,614 publications by 6,186 authors. As a working taxonomist who participated in this epic bio-bibliography I am very satisfied, especially when I find the information I need on publications and their authors in connection with my present work on some of the wattles for the *Flora of Australia*.

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History is now

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Abstract

The paper highlights the value of keeping records that will be useful to future historians. These include manuscripts, research records, correspondence, records of phone and personal discussions, personal bibliographies, newspaper items, notices of meetings, advertisements, receipts for accommodation and purchases, photographs people, buildings and natural sites, and field books.

During this symposium we have heard the fruits of much thorough research into Australia's botanical history. We should, however, ask: what are we doing for those who come after us? Are we keeping adequate records? Brian Morley has discussed some of the needs regarding botanical art. I here address other aspects of keeping historical records.

How many of us have searched fruitlessly for information on a botanist, a collector, an artist, or a locality? We explore all avenues — literature, note books, archives, personal contacts, but that piece of information is just not there, has disappeared like the origin of the angiosperms.

Along the way we have probably unearthed intriguing facts or been lured into side-tracks not always relevant to the immediate objective. Throughout this symposium we have heard of detective work that has solved — or perhaps not solved — a wide range of matters of botanical history and documentation.

Sometimes this work is essential to research, e.g. to determine the application of a name or trace a type locality. At other times it is simply fascinating in its own right — which in no way is to be derided, for interest in history is part of the human make-up. Our presence at this meeting shows that.

I set before you the kinds of records that we should be keeping so that future historians may have an easier task than us. These are mainly of an institutional and personal nature; items such as society newsletters and notices of meetings should be retained by the organization concerned.

Essential records

Correspondence

This is a primary resource for the historian. Most employers, whether government or private industry, maintain a filing system that is relatively easy to use. Files are classified according to subject or staff member, sometimes with a new set each year. Provision should be made for them to be archived when no longer needed in the registry. Private correspondence should also be kept.

I have noticed that some botanists do not file all official correspondence, however, but retain it in their offices. In the case of public servants this is against regulations. The serious drawbacks to this system are the possibility of loss (especially when the person retires or changes jobs) and inaccessibility to others. Letters do sometimes contain personal matters that need not or should not be filed, but a photocopy of the 'official' text may be retained. The personal bits, of course, could be of great interest to a historian!

Journal and diaries

Many people keep a journal or diary of their main activities, often as a requirement of their employer. These can be most useful for checking events, progress, visitors, receipt of publications, etc.

Manuscripts

Original drafts should be archived. They may be useful, e.g. to check authorship. Retaining them is becoming less feasible, however, as more people compile papers directly on disk. In these cases a first print-out should be kept.In conjunction with the draft, supplementary notes, sketches, literature extracts and other material used to draft a paper can be important since they may contain ideas and comments excluded from the publication.

Records of telephone calls

Much 'correspondence' is now conducted by phone. While the substance of these is often incorporated into a manuscript or other activity, it should also be recorded as a note for the relevant correspondence file. Unfortunately this is often not done, sometimes leading to problems or a follow-up call when the substance or the date cannot be recalled accurately. This is especially critical when other people are involved in the subsequent action. Remember — the call and the record together take less time than formal correspondence. You are still ahead on time!

Computer mail

The sequel to telephone communication is the computer. Messages are now frequently sent by this means but no record is kept. Either a printout or a handwritten note should be filed.

Visitor books

These usually are retained and are an obvious source of information. In addition, the entries are usually

made by visitors themselves and thus might be useful as handwriting samples.

Minutes of meetings
Although there should be an official file copy of these, it will then be somewhat distant from your other personal records. A set places on a research file will make it easier for the historian to trace personal involvement and contributions. Personal notes taken at meetings (including doodles) should also be kept.

Field books
These are of prime importance and should always be safely stored, with provisions for archiving. We have only to consider how useful it would be to have field books of James Drummond and Ferdinand Mueller to understand their value. There is often only one copy of field books, and supplementary data are often included that do not find their way onto herbarium labels, e.g. other personnel on the expedition, people met, weather, vehicles, comments on the later determinations.

Ensure that field books are legible and intelligible to yourself and others. A speedometer reading with no reference point may be useless! A mud map can be an invaluable in accurately defining an obscure locality.

Personal publications
Many of us are aware how difficult it can be to trace all the published work of an individual. There is little problem with major writings, but those of small circulation or of ephemeral nature (e.g. newsletters, newspapers) are easily overlooked. Here, two courses of action should be maintained: first, a set of all one's publications, and second, an up-to-date bibliography.

Optional records

Staff appointments and departures
Dates are kept with personal files, etc., but it is worth keeping a separate register for ready reference. Few people can recall precise dates of someone joining and leaving the staff.

Other travel records
Transport tickets contain information usually not kept elsewhere — especially schedules and fares — not to overlook the carrier. The Western Australian Herbarium has, for example, books of railway tickets issued to Charles Gardner in the 1940s. They contain the carbon copy and would be useful to a biographer tracing his movements at that period.

Copies of departmental travel forms contain similar information.

Photographs
These are both informative and of the greatest human interest, often going far beyond a pictorial representation of people and places. Their reproduction in a historical account enhances the work immeasurably.

Special care should be taken with storage. Colour slides and prints often deteriorate with age, and should be checked regularly (if only every few years). Important shots should be duplicated to extend longevity. Black and white film and prints are longer-lasting than colour and cheaper to reproduce.

Newspaper and magazine cuttings
These can be useful for indicating current issues and public interest through news items, feature articles and letters to editors. Poor-quality paper is a long-term storage problem and indexing is difficult, but they should be retained, and posterity can assess the longer-term importance. The simplest storage is articles glued on sheets and stored in punched files in chronological order. Newspapers retain published prints for a short period. The negatives (which include far more photographs than are published) are usually offered to a major library for archiving after this initial period.

Inventories of field equipment
Just as we study lists of equipment taken on early voyages and expeditions, so will future historians wish to know what we take. Very often there is no written record, making it all the more important to keep those that exist. Remember, our vehicles and some equipment will seem quaint in a hundred years' time — though the plant press may be similar. Food lists should be included with this item.

What I have mentioned is the ideal. There are four main problems in maintaining extensive records: the time required, the archival quality of the materials on which they are stores, storage space, and indexing. Each person must assess what should be kept, and how. To a large extent the problems of materials and storage are for those charged with archiving our records after we no longer need them. But we should at least ensure that provision is made for the option to archive. If we do this, then perhaps in the tricentennial year, 2088, the Society will have another memorable symposium!

Index

This is a guide to the names of botanists and associated people (sometimes excluding members of the family of a botanist) and to the names of ships mentioned in the text. Pages with photographs of people are in bold.